LeCours, Catherine

From: Hoogerheide.Roger@epamail.epa.gov
Sent: Friday, January 26, 2007 8:45 AM
To: LeCours, Catherine
Subject: Fw: TAPE comments (cont.)
Follow Up Flag: Follow up
Flag Status: Blue
Attachments: TAPE-Soil Sampling3-13-06 wo 1-26-07.doc

Minimal comments

-----Forwarded by Roger Hoogerheide/R8/USEPA/US on 01/26/2007 08:44AM -----

To: hoogerheide.roger@epa.gov
From: Wendy OBrien/EPR/R8/USEPA/US
Date: 01/26/2007 06:52AM
cc: goldade.mary@epa.gov, miller.aubrey@epa.gov, peronard.paul@epa.gov, costanzi.frances@epa.gov, luey.jim@epa.gov
Subject: TAPE comments (cont.)

a couple of comments on the TAPE soil sampling guidance.

wo

TROY ASBESTOS PROPERTY EVALUATION (TAPE)

PROJECT-SPECIFIC GUIDANCE

TAPE Surface Soil Sampling
Version 01

Prepared for:
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
P.O. Box 200901
Helena, MT 59620-0901

Prepared by:
TETRA TECH EM INC.
7 West 6th Avenue
Helena, MT 59601

Date:
March 13, 2006

1.0 BACKGROUND AND PURPOSE

The purpose of this TAPE project-specific guidance is to provide a standardized method for surface (0 to 1 inch) and shallow subsurface (0 to 6 inch) soil sampling to be used by the Montana Department of Environmental Quality (MDEQ) and their contractor, Tetra Tech, while completing work for the Troy asbestos property evaluations (TAPE) for the Libby Asbestos Project in Libby, Montana. This guidance describes the equipment and operations used for sampling surface and subsurface soils in residential areas, which will be submitted for the analysis of Libby amphiboles.

The MDEQ project manager must approve site-specific deviations from the procedures outlined in this document prior to initiation of the sampling activity. This guidance provides the protocols for selecting sample locations and for composite surface-soil sampling. Field personnel performing soil sampling are responsible for adhering to the applicable tasks outlined in this project-specific guidance while collecting samples at residences. The field personnel should have limited discretion with regard to collection procedures, but should exercise judgment regarding the exact location of the sample point, within the boundaries outlined by the TAPE field team leader.

2.0 TAPE OUTDOOR SOIL SAMPLING PROCEDURES

Each property will be segregated into land use areas for sampling purposes. Use areas may include, but are not be limited to:

- Yard (grassy area)
- Landscaped area
- Garden
- Fill area
- Driveway

Comment [MSOffice1]: Suggest using land use definitions consistent with those used in visible vermiculite sop (e.g., specific use are, non use area, limited use area, common use area

The areas of the Troy properties that are not covered by buildings will be grouped into two general types: (1) outdoor yards and open space, and (2) specific use areas. Figure 3-2 in the TAPE Workplan provides typical outdoor soil sampling designs for these two general types of outdoor areas. Properties with grassy areas greater than approximately 5,000 square feet (ft^2) in size will be sectioned off into separate zones for increased accuracy in characterization. This segregation will be accomplished so that a 30-point composite sample will characterize each section.

Deleted: five

Sample Number and Location: A minimum of two and up to five composite soil samples will be collected from outside areas at each property. Composite soil sampling requires soil collection from multiple (sub-sample) points. Composite samples will be collected from similar land use areas (for example, yard, garden, stockpiled soil). Additional composite or individual grab samples may be collected depending on specific property conditions (for example, multiple land use areas or zones). Not all Troy properties will have definable land use areas, however, the TAPE field team will attempt to collect a minimum of two soil samples from each Troy property.

A surface soil sample will be collected from the 0 to 1 inch depth at sample points within non-disturbed areas (grassed yards). For disturbed areas (driveways, gardens, fill areas, and landscaped areas), composite soil samples will be collected from 0 to 6 inch depth. All composite soils samples will have five subsamples (aliquots) of approximately equal size. When vermiculite is observed in a land use areas (driveways and yards), a soil sample should be collected from that land use area. The location where any vermiculite is observed during soil sampling should be recorded in the field logbook and on the IFF.

Comment [MSOffice2]: Consider sampling depths consistent with those specified in visible vermiculite sop.

Sample Collection: Field samplers should don the appropriate PPE as specified in the HASP. New plastic gloves are to be worn for each sample collected. Segregate the Troy property into land use areas, as described above. Visually inspect each land use area for visual vermiculite product. To reduce dust generation during sampling, use a sprayer with distilled water to wet each sample point prior to collection. Use the trowel to check beneath the surface soil layer, but do not advance more than 6 inches. If visible vermiculite is observed, that information should be recorded on the appropriate field forms for that land use area. Sample locations should be selected as described

Within each land use area, select five subsample locations equidistant from each other (Figure 3-2). These five subsample locations will comprise the five-point composite sample for that land use area. All composite subsamples should be from the same land use area. For example, do not mix subsamples from a garden area with subsamples from a grassy area.

Remove twigs, leaves, and other vegetative material that can be easily removed by hand at each subsample location. Using the trowel, excavate soil from an area approximately 2 inches in diameter and 1 inch deep (6 inches deep for disturbed areas) and place the excavated material directly inside a 1-gallon size reclosable plastic bag. The sides of the excavated hole should be close to vertical to avoid sampling that is biased in favor of the upper layer of soil. Repeat this step for the remaining four subsamples until the composite subsamples has been collected. The reclosable plastic bag should be approximately 1/3 to ½ full.

Homogenize the sample by first closing the plastic bag and then vigorously kneading and working the soil back and forth. Some samples may require one minute, or more, of mixing in order to thoroughly homogenize. A pre-printed, self-adhesive sample ID label will be attached to the outside of the plastic sample bag. The sample will then be double bagged and the labeling process repeated for the outer sample bag. Decontaminate the trowel between each composite soil sample, as described below.

Repeat the soil sampling steps outlined above until all soil samples from a property have been collected. Soil field duplicate samples will be collected at a rate of 1 per 20 (5 percent) of the field samples. Field duplicate samples will be collected as samples co-located in the same land use area. The duplicate will be collected from the same number of subsamples as the parent sample, but the subsample locations of the duplicate sample will be randomly located in the use area. These samples will be independently collected with separate sampling equipment. The duplicate soil samples will be used to determine the variability of sample results in a given land use area and will not be used to determine variability in sampling techniques.

Sample Location Restoration: The volume of soil removed by the TAPE sampling is small, but care will be used to return and restore each subsample point location to near pre-sampling appearance. For most sample locations, the small area can be replaced with soil from immediately surrounding the excavation and lightly tamped down. In addition, each TAPE field team will have some commercially-available potting soil or quality topsoil available to repair any small excavations that cannot be easily filled with nearby soil materials. If the sample location is a sandy area, such as a playground, refilling the soil plug will not be necessary.

Sample Decontamination: Rinse water, the roots of vegetation removed during sampling, and any small volume of excess soil may be disposed of on the ground as specified in the TAPE Workplan. A small metal shovel (if needed) and plastic trowels are the only sampling equipment that will be reused and thus requiring decontamination between sampling. All soil sampling equipment will be thoroughly decontaminated prior to any sampling use. Specific instructions on sample equipment decontamination are included in TAPE Workplan. In general, the procedure to decontaminate all equipment is outlined below:

Decontamination procedures for soil sampling equipment will follow these steps:

- Remove all gross contamination with plastic brush
- Use distilled (DI) water and a plastic brush to wash each piece of equipment
- Remove excess water present on the equipment by shaking
- Use a paper towel to dry each piece of equipment
- Wrap dried equipment in aluminum foil

Once a week all soil sampling equipment will be cleaning using Alconox and DI water.
Spent wipes, gloves, and PPE must be disposed or stored properly as specified in the TAPE Workplan.

3.0 LISTED EQUIPMENT AND RESOURCES

TAPE soil sampling may require the use of one or more of the following types of equipment and resources:

Sampling Equipment:
Trimble pro-XRS GPS unit
Digital camera
Scale bars for photographs
Phone or radio
Clipboard
Tape Measure (6 x 50-foot)
Field log book
Pocket knife
Re-closable plastic bags
Wet wipes
Waterproof permanent markers
Small metal shovel
Disposable soil trowels/scoops
Sample labels
Silica sand (asbestos-free) for soil field blanks
Secure shipment containers
Trash bags

PPE:
Disposable protective outerwear
Vinyl/nitrile gloves, various sizes

Decon:
Paper towels
Bristle brushes
Water spray bottles
5-gallon buckets
Surfactant (Alconox)
Distilled (DI) water

Field Forms:
IFFs
FSDSs
Interview forms
Field audit forms

DRAFT FINAL

TROY ASBESTOS PROPERTY EVALUATION WORK PLAN
(FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN)

FOR THE

TROY ASBESTOS PROPERTY EVALUATION PROJECT

Troy Operable Unit of the Libby Asbestos Superfund Site

April 2006

Prepared for:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Remediation Division
P.O. Box 200901
Helena, Montana 59620

Contract Number 402014
Contract Task Order Number 41

Prepared by:

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DRAFT FINAL

TROY ASBESTOS PROPERTY EVALUATION WORK PLAN
(FIELD SAMPLING PLAN/QUALITY ASSURANCE PROJECT PLAN)

FOR THE

TROY ASBESTOS PROPERTY EVALUATION PROJECT

Prepared for:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

REVIEWS AND APPROVALS

Tetra Tech EM Inc. Project Manager: ______________________________ Date: ____________
J. Edward Surbrugg, Ph.D.

DEQ Project Officer: ______________________________ Date: ____________
Catherine LeCours

EPA Remedial Project Manager: ______________________________ Date: ____________
Peggy Churchill

DISTRIBUTION LIST

Name	Responsibility	Affiliation
Catherine LeCours	DEQ Project Officer	Montana Department of Environmental Quality – Helena, Montana
J. Edward Surbrugg	Tetra Tech Project Manager	Tetra Tech EM Inc. – Helena, Montana
Peggy Churchill	EPA Remedial Project Manager	EPA – Denver, Colorado
Mike Cirian	EPA Remedial Project Manager	EPA – Libby, Montana
Jeff Montera	CDM Libby Project Manager	CDM – Denver, Colorado
Mark Raney	Volpe Libby Technical Lead	Department of Transportation, Volpe Center – Cambridge, Massachusetts
Pat Carnes	Volpe Libby Database Project Manager	Department of Transportation, Volpe Center – Cambridge, Massachusetts
Terry Crowell	CDM Libby Sample Coordinator	CDM – Libby, Montana

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ACRONYMS AND ABBREVIATIONS

AHERA	Asbestos Hazard Emergency Response Act
amsl	Above mean sea level
ASTM	ASTM International (formerly the American Society for Testing and Materials)
CDM	Camp Dresser & McKee
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
cm^2	Square centimeters
CPR	Cardiopulmonary resuscitation
DEQ	Montana Department of Environmental Quality
DPHHS	Montana Department of Public Health and Human Services
DQO	Data quality objective
eLastic	Electronic Libby Asbestos Sample Tracking Information Center
EPA	U.S. Environmental Protection Agency
FSDS	Field sampling data sheet
GPS	Global positioning system
HASP	Health and safety plan
HAZWOPER	Hazardous waste operations
IFF	Inspection field form
LA	Libby amphibole
Microvac	Microvacuum
mm	Millimeters
OSHA	Occupational Safety and Health Administration
OU	Operable unit
PPE	Personal protective equipment
PLM	Polarized light microscopy
QA	Quality assurance
QC	Quality control
SOP	Standard operating procedure
TAPE	Troy Asbestos Property Evaluation
Tetra Tech	Tetra Tech EM Inc.
µm	Micrometers
VCI	Vermiculite-containing insulation
Volpe Center	John A. Volpe National Transportation Systems Center

1.0 PROJECT DESCRIPTION AND BACKGROUND

Tetra Tech EM Inc. (Tetra Tech) received Task Order No. 41 from the Montana Department of Environmental Quality, Remediation Division (DEQ), under DEQ Contract No. 402014. The purpose of this task order is to complete a Troy Asbestos Property Evaluation (TAPE) Work Plan for the Troy Operable Unit (OU) of the Libby Asbestos Superfund Site. The United States Environmental Protection Agency (EPA) is the lead agency for the Libby Asbestos Superfund Site. DEQ is the lead agency for the Troy OU through a Cooperative Agreement with EPA. EPA requested DEQ lead the Troy OU for efficient resource allocation. The TAPE Work Plan describes the field and property inspections and sample collection necessary to identify if and where asbestos is present within the Troy OU and the concentrations and quantity, if present. This information will be used at a later date to support cleanup decisions.

This TAPE Work Plan document is a combined field sampling plan and quality assurance project plan and is referred to as the TAPE Work Plan. Tables and figures in this document follow the first reference in the text. Appendix A contains the site-specific health and safety plan (HASP), Appendix B contains copies of project-applicable standard operating procedures (SOPs), Appendix C is a list of equipment and supplies required for the project, Appendix D contains samples of information for residents, and Appendix E contains example TAPE project field forms.

1.1 PROJECT BACKGROUND AND PURPOSE FOR SAMPLING

Troy, Montana, is located 18 miles northwest of Libby, Montana. From the 1920s until 1990, an active vermiculite mine and associated processing operations were located at Libby. While it was in operation, the vermiculite mine in Libby may have produced 80 percent of the world's supply of vermiculite (EPA 2005). Vermiculite is used primarily for insulation in buildings and as a soil amendment. The vermiculite deposit is contaminated with a form of amphibole asbestos (Libby amphibole [LA]) that is considered a carcinogen. Asbestos is a known carcinogen and is associated with a multitude of respiratory health effects, including asbestosis, lung cancer, and mesothelioma. For decades, vermiculite ore and waste materials were ubiquitous in the Libby community while the mine operated and after its closure.

In 1999, EPA Region 8 dispatched an emergency response team to investigate in response to media reports that described a high rate of asbestos-related deaths in Libby. The Agency for Toxic Substances and Disease Registry (ATSDR) has since determined that between 1978 and 1998 asbestosis mortality in

Libby was 40 times to 80 times higher than expected in Montana and the United States, and lung cancer mortality was approximately 20 percent to 30 percent higher than expected in Montana and the United States (ATSDR 2002). Originally believed to be a problem limited to the mine workers, the scope increased. Subsequent environmental investigations have found many areas in and around Libby contaminated with LA. EPA began Time Critical Removal Actions in Libby in 1999 through a two-phased approach. The Phase I investigation was used to determine if a time critical removal action was warranted in Libby to protect human health, to identify potential major source areas, and to identify the appropriate analytical methods for measuring concentrations of LA in those source materials (CDM 2002). The Phase II investigation was used to collect detailed information about airborne concentrations in air that result from sources of contamination that are disturbed (CDM 2003b). The combined results from the Phase I and II investigation include:

- Exposure to LA is a threat to human health.
- Release of respirable LA fibers occurs when source materials are disturbed.
- Source materials include vermiculite insulation, vermiculite products (building materials) and process wastes, and contaminated soils.
- Contaminated indoor dust found in residential and commercial properties is a potential exposure pathway.
- There is widespread presence of LA throughout the Libby area.

As a result of the findings from the Phase I and II investigations, and because the Libby Asbestos Superfund Site was listed on the National Priorities List in 2002, EPA further investigated residences and businesses in the Libby study area boundary (EPA 2003b). EPA began the Libby Asbestos Superfund Site Contaminant Screening Study, which was considered the first part of the Remedial Investigation, in 2002. The goal of the Contaminant Screening Study was (and is) to determine which properties in Libby contained LA source materials (CDM 2003a). As of December 2005, EPA and their contractors have investigated 4,029 properties in the Libby area through the Contaminant Screening Study.

The purpose of the TAPE is identical to that of the Contaminant Screening Study. Limited investigations thus far have found the vermiculite insulation found in Troy is morphologically similar to that in Libby (USGS 2005). The draft Troy Site Conceptual Model (Section 1.2) illustrates that potential exposures in Troy are similar to those in Libby, therefore, a systematic screening of Troy area residences and business is necessary to gather sufficient information to determine how many Troy area properties are contaminated with LA. Some vermiculite mine workers lived in Troy and commuted to the mine to work each day. The mine workers were exposed to asbestos-contaminated materials at the mine and processing facilities, and they transported asbestos-contaminated dust to their homes on clothes and equipment. Residents of Troy also traveled to Libby for everyday activities such as shopping, working (other than at the mine), and attending school sporting events and likely came in contact with LA in Libby during these frequent visits. In addition, the asbestos-contaminated vermiculite ore and waste materials in varying forms may have been used for amending soils (as fill or as a conditioner), building materials (plaster, concrete, or chinking amendment), and for insulating buildings in and around Troy.

1.2 SITE CONCEPTUAL MODEL

Asbestos exposure is a potential human health concern because chronic inhalation of excessive levels of asbestos fibers suspended in air can result in lung diseases such as asbestosis and mesothelioma. The relationship between asbestos exposure and mesothelioma has been documented, and at least 70 percent of people with mesothelioma report that they have been exposed to asbestos (National Cancer Institute 2005). Figure 1-1 presents a draft Site Conceptual Model for Troy, which identifies exposure pathways by which asbestos fibers from the Libby mine might be inhaled or ingested by humans. The draft Site Conceptual Model will be refined as additional data are acquired and the understanding of actual transport and exposure pathways for Troy is improved. EPA, CDM, and the Montana Department of Public Health and Human Services (Montana DPHHS) have provided additional related background information for the Libby asbestos project and on mesothelioma in Montana (CDM 2003; Montana DPHHS 2005).

1.3 TROY SITE INFORMATION

The Troy OU is located along the Kootenai River valley at an elevation ranging from 1,850 feet above mean sea level (amsl) at the northern end of the OU to 2,500 feet amsl on the mountain slopes surrounding the valley. The Troy OU is approximately 8 miles long and up to 1.8 miles wide. Topography of the Troy OU consists of relatively flat river valley terraces on both sides of a gently graded Kootenai River. Several tributaries flow into the Kootenai River along the 8-mile stretch contained within the Troy OU. Figure 1-2 provides a topographic view of the Troy OU boundaries.

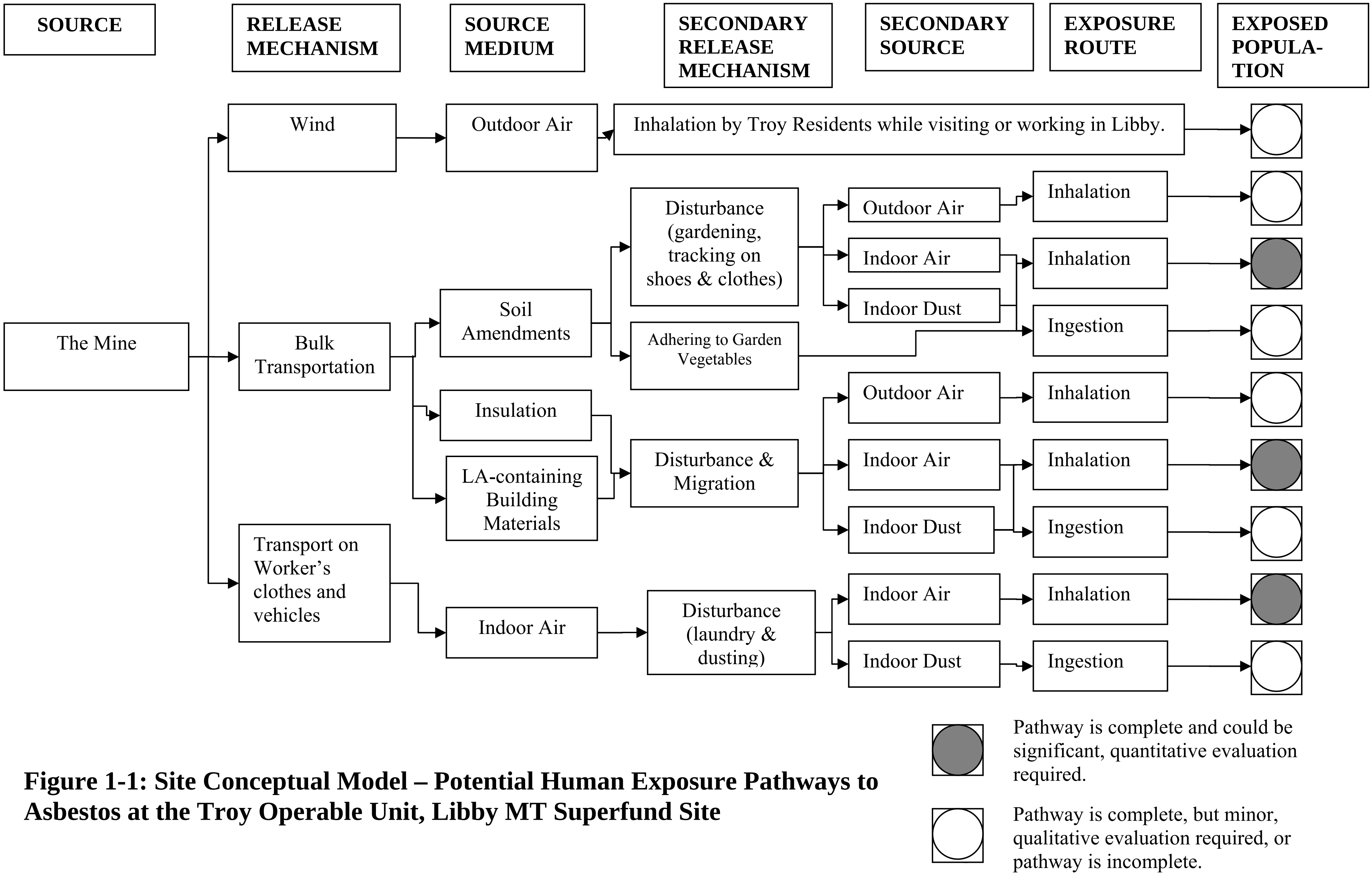
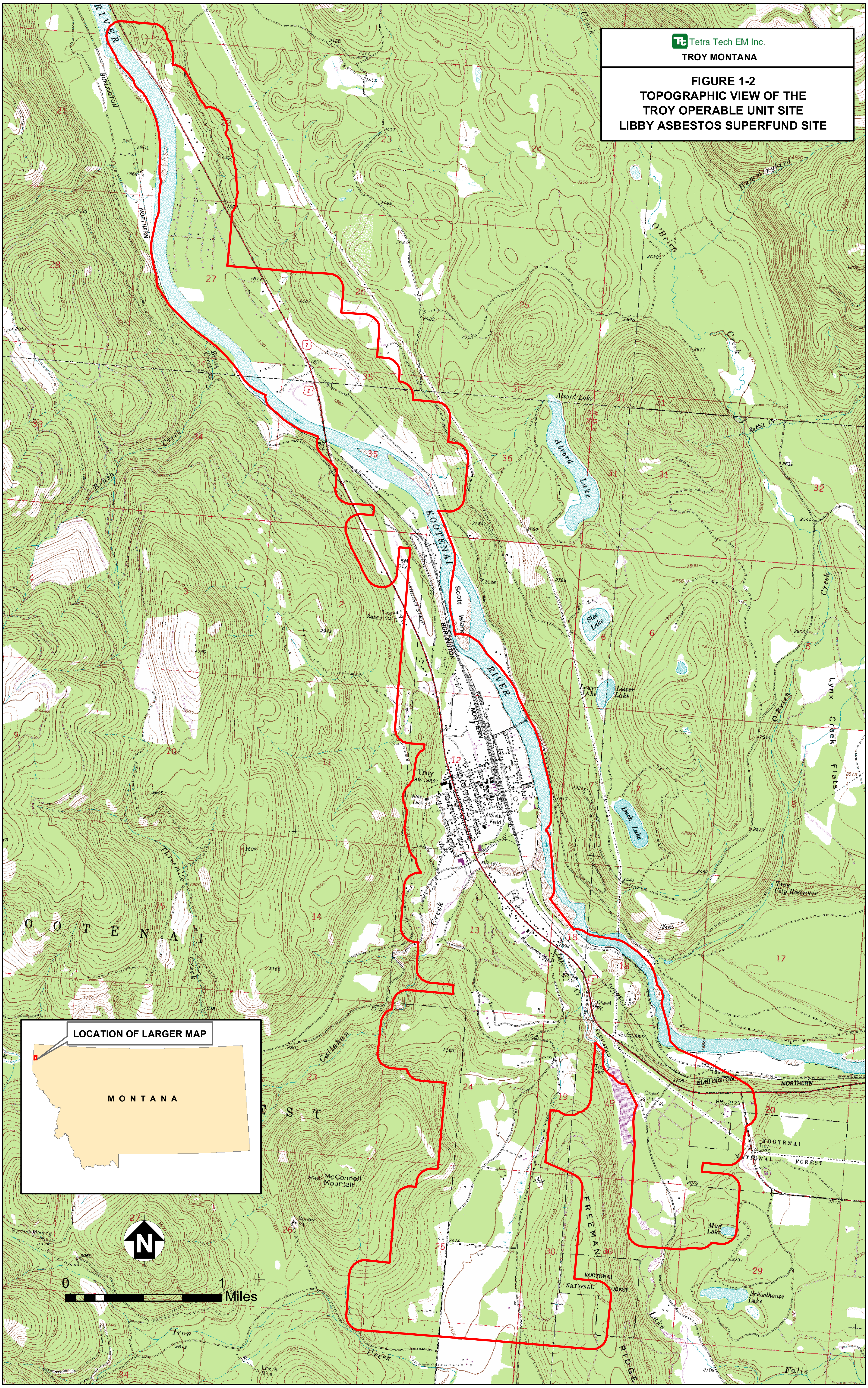


Figure 1-1: Site Conceptual Model – Potential Human Exposure Pathways to Asbestos at the Troy Operable Unit, Libby MT Superfund Site



GIS map by Ed Madej TTEMI-HE
Fig_1-2_troy_basemap_study_area_031206.mxd

1.4 SCHEDULE

The schedule for the TAPE inspection and sampling field work is pending DEQ receiving adequate EPA funding. The TAPE field work may begin in the summer 2006 and would require approximately 75 full work-days to complete (15 weeks) based on an average of 15 total TAPE inspections per full day. The soil and dust samples collected from the TAPE field work will be prepared for analysis by CDM and analyzed for asbestos concentrations by a contract laboratory. Analysis of the samples is also dependent upon adequate EPA funding. Tetra Tech will prepare a TAPE Field Summary Report approximately 90 days after the completion of the field work. The draft TAPE project report would be submitted to the DEQ and others approximately 60 days after receiving the analytical data.

1.5 REPORT ORGANIZATION

This TAPE Work Plan is organized into eight sections. Section 1.0 is this introduction. The contents of Sections 2.0 through 8.0 are briefly described below.

- Section 2.0 Project Organization. This section identifies key project personnel and project responsibilities and provides an organizational chart and a table of participants with contact information.

- Section 3.0 Work Plan Rationale. This section describes the data quality objective (DQOs) steps used to establish the quantity and the quality of data to support decision making.

- Section 4.0 Field Procedures. This section describes the activities that will take place during the property evaluations. The SOPs for each activity and the HASP are referenced and detailed.

- Section 5.0 Field Quality Control Procedures: This section discusses the field quality assurance and quality control (QA/QC) procedures, including equipment decontamination, QA samples, field documentation, and chain of custody. Also discussed in this section are QA procedures used at the Libby Asbestos Superfund Site (EPA 2000c).

- Section 6.0 Data Management. This section describes how the data will be handled after they have been received from the Libby V2 database.

- Section 7.0 QA/QC Procedures. This section will describe the procedures that will be taken to ensure the quality and integrity of the TAPE data.

Finally, references used in preparing this document are presented in Section 8.0.

2.0 PROJECT ORGANIZATION

Table 2-1 presents the responsibilities and contact information for key personnel involved in the TAPE inspection and sampling project. In some cases, more than one responsibility has been assigned to a person.

The John A. Volpe National Transportation Systems Center (Volpe Center) is providing support to EPA Region VIII, including management of the Libby V2 database which is used to track sampling, analytical, and other pertinent data from the Libby Asbestos Superfund Site. Tetra Tech will transfer Troy data to and obtain data from EPA and their contractors. Tetra Tech will transfer custody of all soil and dust samples to CDM after the samples have been recorded and organized. CDM will then be responsible for custody and quality assurance of the samples until delivery to a contract laboratory for analysis. CDM contracts all analytical laboratories used for the Libby Asbestos Superfund Site. Therefore, CDM will oversee laboratory schedules and track data deliverables.

2.1 MONTANA DEQ OVERSIGHT

The DEQ Project Officer (or designee) will provide oversight of all field activities associated with this TAPE project. DEQ oversight personnel will have the ability to inspect all field and sampling activities, determine the appropriateness of the recorded data, and ensure that all activities comply with standard practices that meet the project objectives. Before any oversight is conducted, the Tetra Tech on-site health and safety coordinator will brief the DEQ oversight personnel to ensure safe practices are maintained throughout the TAPE field effort.

2.2 NON-AGENCY OBSERVATION OF FIELD ACTIVITIES

EPA will be allowed the opportunity to observe the TAPE project field activities. The request for non-Agency observation of field activities must first be coordinated with and approved by the DEQ Project Officer and the individual property owner. When inspection and sampling are being conducted on a Troy property and the owners are present, the property owners will have the opportunity to (1) observe Tetra Tech field inspection and sampling in a safe manner, (2) obtain copies of the field forms and property sketches completed for the property, (3) obtain a receipt for samples collected, and (4) obtain a portion of samples collected (at the cost of the property owner). The Tetra Tech field team will brief property owners about the types of sampling and methods for completing the TAPE inspection and sampling;

however, the Tetra Tech field team will not interpret results or make conclusions from the inspection and sampling for the property owner.

If Tetra Tech obtains soil or dust samples at a property, Tetra Tech will, if requested, provide the property owner with a receipt for the samples identifying the number and types of samples collected before the field crew leaves the property. No sample results will be available during the TAPE inspection and sampling. An individual property owner who requests a portion of a sample must supply all necessary materials required for sampling, as well as arrange and pay for laboratory analysis of all additional samples collected.

2.3 SPECIAL TRAINING AND CERTIFICATES

Tetra Tech personnel who work on the TAPE project will have met the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 Code of Federal Regulations (29 CFR) Part 1910.120(e) for working on hazardous waste sites. These requirements include: (1) 40 hours of formal off-site instruction; (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training. In addition, all Tetra Tech personnel working on the TAPE project will have taken the Asbestos Hazard Emergency Response Act (AHERA) 24-hour asbestos inspector training course and will hold a current asbestos inspector license issued by the State of Montana.

Tetra Tech personnel working on the TAPE project must read and abide by the stipulations and guidelines set forth in Tetra Tech's HASP, which is Appendix A to this TAPE Work Plan. The HASP provides written instructions for health and safety training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every Tetra Tech field team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation (CPR) Modular" or equivalent.

Copies of Tetra Tech's health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized AHERA training, and first aid and CPR training, are maintained in the Helena Tetra Tech office files for all TAPE field team members.

TABLE 2-1

KEY PERSONNEL

Name	Organization	Role	Responsibilities	Contact Information
Catherine LeCours	DEQ	Project Officer	• Monitors performance of the contractor • Reviews and approves all work plans and QA measures (FSP/QAPP) • Provides coordination with EPA, Volpe, and CDM • Provides primary interface with the Troy community and disseminate project information to the public	Montana Department of Environmental Quality PO Box 200901 Helena, MT 59620-0901 clecours@mt.gov (406) 841-5040
J. Edward Surbrugg	Tetra Tech	TAPE Project Manager	• Responsible for implementing all activities called out in the task order • Supervises preparation of work plan and approves document • Monitors and directs field activities to ensure compliance with work plan requirements • Provides coordination with DEQ Project Officer • Disseminate project information to interested parties and Troy property owners and direct questions to DEQ	Tetra Tech, Helena, MT 7 West 6th Avenue Helena, MT 59601 edward.surbrugg@ttemi.com (406) 442-5588
Mark Stockwell	Tetra Tech	- TAPE Field Team Leader - TAPE QA/QC Manager	• Responsible for directing and coordinating day-to-day field activities conducted by Tetra Tech • Verifies that field sampling and measurement procedures follow work plan • Conducts field audits for QA/QC • Provides DEQ Project Officer and TAPE project manager with regular reports on status of field activities • Disseminate project information to interested parties and Troy property owners and direct questions to TAPE project manager or DEQ	Tetra Tech, Sandpoint 324 Larchwood Drive Sagle, ID 83860 mark.stockwell@ttemi.com (208) 263-4524

TABLE 2-1
(Continued)

KEY PERSONNEL

Name	Organization	Role	Responsibilities	Contact Information
Jessica Allewalt	Tetra Tech	Troy Field Data Coordinator	• Responsible for working with TAPE project manager and TAPE field team leader to schedule TAPE inspections • Responsible for compiling, organizing, and auditing field data sheets and samples submitted daily by field teams • Responsible for transferring field data sheets and samples to the CDM Troy Sample Coordinator • Coordinate with CDM, EPA, and Volpe managers on sample delivery schedules and logistics • Reviews laboratory data before release to project team • Disseminate project information to interested parties and Troy property owners and direct questions to TAPE project manager or DEQ	Tetra Tech, Helena, MT 7 West 6th Avenue Helena, MT 59601 jessica.allewalt@ttemi.com (406) 442-5588
Joe Faubion	Tetra Tech	On-site TAPE Safety Officer	• Responsible for implementing health and safety plan and for determining appropriate site control measures and personal protection levels • Conducts safety briefings for Tetra Tech and site visitors • Can suspend operations that threaten health and safety • Disseminate project information to interested parties and Troy property owners and direct questions to TAPE project manager or DEQ	Tetra Tech, Helena, MT 7 West 6th Avenue Helena, MT 59601 joseph.faubion@ttemi.com (406) 442-5588
Ed Madej	Tetra Tech	Database and Geographic Information System Manager	• Responsible for developing, monitoring, and maintaining project database and property maps • Responds to requests from TAPE project manager and TAPE field team leader to provide copies of property maps to field teams on a daily basis • Works with CDM, Volpe, and EPA data and graphic managers to generate needed reports and maps from the Libby V2 database	Tetra Tech, Helena, MT 7 West 6th Avenue Helena, MT 59601 ed.madej@ttemi.com (406) 442-5588

TABLE 2-1
(Continued)

KEY PERSONNEL

Name	Organization	Role	Responsibilities	Contact Information
10 members	Tetra Tech	Field Team Member	• Responsible for conducting TAPE inspections and sampling as described in the work plan and for following SOPs. • Disseminate project information to interested parties and Troy property owners and direct questions to TAPE project manager or DEQ	Tetra Tech, Helena, MT 7 West 6th Avenue Helena, MT 59601 (406) 442-5588
TBD	CDM Troy Sample Coordinator	Troy Sample Coordinator from CDM	• Accepts FSDSs and corresponding samples from Tetra Tech • Responsible for quality review of electronic data entered by Tetra Tech • Coordinates with the CDM laboratory coordinator regarding laboratory or archive storage assignments • Prepares chain-of-custody forms (COCs); ships or hand delivers samples as necessary • Coordinates with the Tetra Tech Field Data Coordinator regarding laboratory sample/data issues; assists in the revision of FSDSs, electronic data, and COCs as necessary • Exports electronic data to the Volpe data manager (for upload into the Libby V2 database) and resolves any export file issues • Provides general quality control input for consistency with Libby project sample and data collection requirements	Troy Field Office TBD
Courtney Zamora	Volpe Center, US DOT	Libby Site Manager/Field Representative	• Field Representative for Volpe Center • Review documents from Troy for consistency with Libby • Respond to resident's requests and concerns in Libby	EPA Information Center 501 Mineral Ave Libby, MT 59923 (406) 293-6194 Courtney.zamora@volpe.dot.gov
Shawn Oliveria	CDM	Libby Site Health and Safety Manager	• Health and Safety Manager for Libby Asbestos Project • Handle regulatory compliance for all dirty work operations and material handling procedures.	CDM Libby Office 60 Port Blvd Libby, MT 59923 (406) 293-8595 (office) (406) 293-1547 (cell)

TABLE 2-1
(Continued)

KEY PERSONNEL

Mike Cirian	EPA	Remedial Project Manager/ Environmental Engineer	• On-Site Remedial Project Manager for the Libby Asbestos Superfund Site • Manage construction activities • Resolve conflict and respond to residential inquiries in Libby	EPA Information Center 501 Mineral Ave Libby, MT 59923 (406) 293-6194 Cirian.mike@epa.gov

Notes:

CDM	Camp Dresser & McKee	DEQ	Montana Dept. of Environmental Quality
EPA	U.S. Environmental Protection Agency	FSP	Field Sampling Plan
QAPP	Quality Assurance Project Plan	SOP	Standard Operating Procedure
TAPE	Troy Asbestos Property Evaluations	TBD	To be determined
Volpe	John A. Volpe National Transportation Systems Center	Tetra Tech	Tetra Tech EM Inc.
QA/QC	Quality Assurance/Quality Control		

Before work begins at a specific project site, Tetra Tech personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for health and safety at a project site
- Health and safety hazards present on site, including heat, physical stressors, insects and other potential biological hazards
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances, physical stressors (heat, cold), and other potential hazards
- Contents of the HASP

3.0 TROY DATA QUALITY OBJECTIVES

This section presents the DQOs for the TAPE inspection and sampling project. The DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA 2000a, 2000b). The DQOs help to clarify the study objectives, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. The seven steps of the DQO process for this TAPE project are presented in Table 3-1.

Background information for the Troy OU study area was discussed in Section 1.0 as was a draft Site Conceptual Model (Figure 1-1). The Troy properties, where sources of LA contamination may be found, are not predictable; DEQ has therefore determined that each property in the Troy OU (including privately-owned and publicly-owned property) will be investigated and screened. The properties may or may not contain a building, or multiple buildings; specific use areas (gardens, former gardens, flower beds, gravel and dirt driveways, and play areas; all are areas with potentially greater exposure or greater use of vermiculite amendments); and yards and open space.

The DQOs will be used to design the TAPE project so that the sampling and analysis are appropriate to provide information to EPA regarding the properties with vermiculite-containing insulation (VCI) and other potential sources of LA contamination (vermiculite, building materials, or soil) within the Troy OU.

TABLE 3-1

DATA QUALITY OBJECTIVES
INVESTIGATION OF TROY OPERABLE UNIT

STEP 1: State the Problem

Section 1.0 of this Work Plan summarizes the history of the Libby Asbestos Superfund Site, identifies the key players and decision makers, illustrates the Site Conceptual Model, provides justification for the investigation and screening for the Troy OU, and identifies the schedule, budget, and necessary resources.

The following are problem statements associated with the Troy Properties investigation:

- Exposure to LA-contaminated vermiculite is a threat to human health (EPA 2000c).
- Respirable LA asbestos is released when source materials are disturbed (EPA 2000c).
- Potential source materials include VCI, LA-containing building materials, vermiculite waste products, and soils contaminated with LA.
- Household dust and indoor air are potential exposure pathways.
- LA-contaminated materials may be found randomly in and around Troy.
- All properties within the Troy OU should be evaluated for sources of LA contamination.

STEP 2: Identify the Decisions

Principle Discussion Question: Do sources of LA contamination exist at properties within the Troy OU?

Property Identification Decisions:

- Identify the potential properties to investigate.
- Identify the number of buildings on each property.
- Identify the number of specific use areas, yards, and open space areas on each property.

Sampling Decisions:

Inspect properties within the Troy OU to visually and analytically confirm the presence or absence of LA contamination in attics, other interior building spaces, and exterior areas, and the concentrations of LA if present.

- Where will interior dust samples be collected?
- Where will building material samples be collected?
- Where will exterior soil samples be collected?

TABLE 3-1 (continued)

DATA QUALITY OBJECTIVES
INVESTIGATION OF TROY OPERABLE UNIT

STEP 3: Identify Inputs to the Decisions
For each property, inputs to the decision include: • Review of aerial photographs to define individual properties, compile addresses, and determine if the property could be individually bought or sold. • Visual inspections of property to determine location and number of buildings, specific use areas, living spaces, and attics. • Documented visible VCI in attics. • Documented visible VCI and other LA-containing building materials in interior building spaces (including but not limited to walls, crawl spaces, etc.). • Documented visible vermiculite in special use areas, yards, or open space areas. • Interviews with residents, owners, occupants, and employees • Analytical results from samples collected at each property.
STEP 4: Define Study Boundaries
• The Troy OU generally consists of the valley bottom from the north half of Section 25, Township 31 North, Range 34 West, and Section 30, Township 31 North, Range 33 West, east to the junction of Highways 56 and 2, and north to the northern edge of Section 21, Township 32 North, Range 34 West. Figure 1-2 shows the configuration of the study area for the Troy OU. • Some properties (approximately 25) within the Troy OU have previously been inspected and sampled under the Libby OU4 investigation. Data have been recorded in the Libby database for these properties and will be integrated with additional sampling data from the TAPE.

TABLE 3-1 (continued)

DATA QUALITY OBJECTIVES
INVESTIGATION OF TROY PROPERTIES

STEP 5: Develop Decision Rules
The Record of Decision for the Troy OU will identify the specific parameters, conditions, and concentrations of LA that determine if a source exists at an individual property and if that source requires cleanup. This Work Plan simply details how DEQ will collect sufficient and defensible information essential to support future cleanup decisions. That information includes conversations with property owners and other anecdotal information regarding historical use of vermiculite, VCI, and other LA containing materials, visual inspections, and sample results. Sampling decisions for the Troy OU are based on sampling protocols and sampling results from the work done in Libby. Cleanup decisions will be based on the presence of and the concentrations of LA. • If VCI is visible in a building attic, then collect dust samples from the living spaces to evaluate the presence and concentrations of LA. • If VCI is not visible in an attic, then collect dust samples from the living spaces to evaluate the presence and concentrations of LA from any secondary indoor or outdoor source of LA. • If vermiculite was used in building materials (plaster, concrete, or chinking), then collect building material samples to evaluate the presence and concentrations of LA from this potential secondary indoor source of LA. • If vermiculite is visible in a building interior, then collect discrete samples to evaluate the presence and concentrations of LA in the area. In addition, collect dust samples from the other building levels or areas to evaluate the presence and concentrations of LA in those living spaces. • If vermiculite is not visible in a building interior, then collect dust samples from the living spaces to evaluate the presence and concentrations of LA from any secondary indoor or outdoor source of LA. • Collect discrete soil samples from specific use areas to evaluate the presence and concentrations of LA. • If the property contains a yard and large open space, then subdivide these areas by similar land uses (for example, grassed areas, driveways, parking areas, and front, back, and side yards) and collect a composite soil sample from each subarea to evaluate the presence and concentrations of LA. Figure 3-1 shows the steps used to inspect and sample buildings and exterior property in the Troy OU. Figure 3-2 provides some typical outdoor soil sampling designs for specific use areas, yards, and open spaces.

TABLE 3-1 (continued)

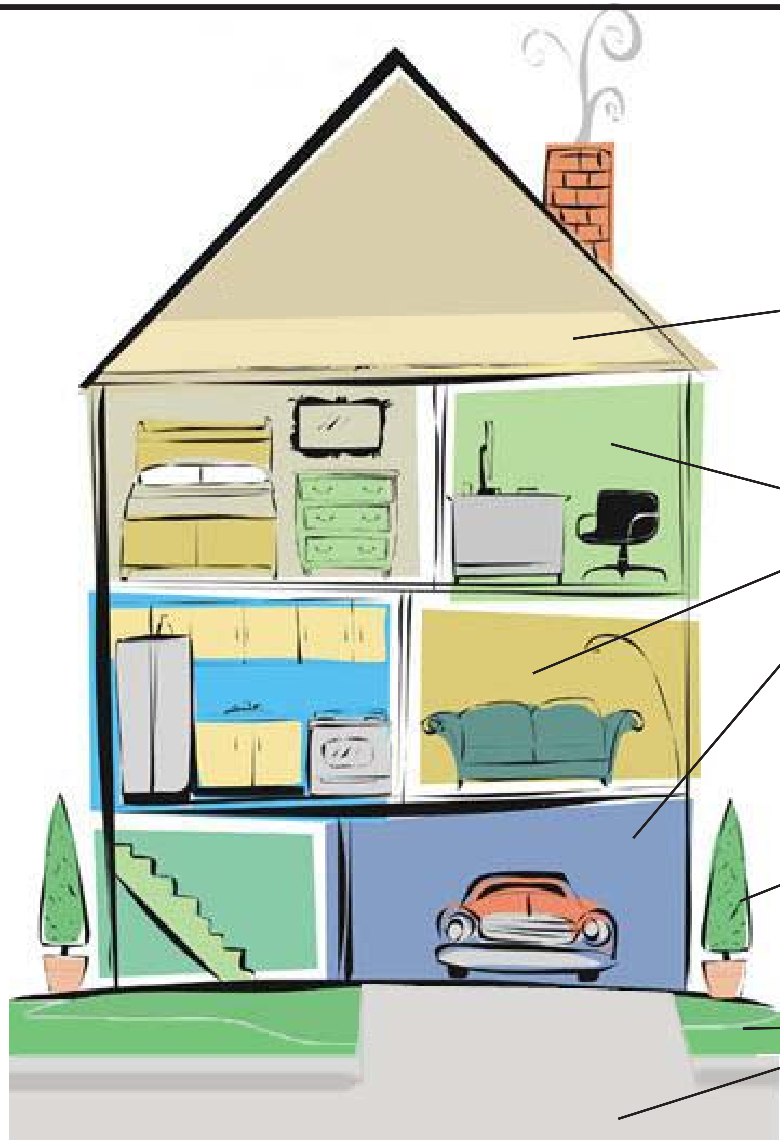
DATA QUALITY OBJECTIVES
INVESTIGATION OF TROY PROPERTIES

STEP 6: Specify Tolerable Limits on Decision Errors
• Sampling and measurement error are associated with environmental data collection and may lead to decision errors. Sampling error occurs when the sample is not representative of the true site conditions. Measurement error occurs because of random and systematic errors associated with sample collection, handling, preparation, analysis, data reduction, and data handling. Decision errors are controlled by adopting a scientific approach that uses hypothesis testing to minimize the potential for error. • There are two types of decision error: false negative error, and false positive error. A false negative decision error occurs when the null hypothesis is rejected although it is true. The consequences of a false negative error would be that VCI or LA-contaminated dust or soil at a Troy property is not remediated. A false positive decision error occurs when the null hypothesis is not rejected although it is false. The consequences of a false positive error are that unnecessary resources are expended to undertake remedial action to address contaminated media that do not exist at concentrations that exceed action levels or acceptable risk levels. • Property-specific sampling objectives and the random distribution of vermiculite and LA-contaminant soil limit the usefulness of statistical methods to eliminate sampling error. Therefore, sampling methods and procedures will be based on results from the Libby Asbestos Superfund Site. Tolerable limits on sampling decision errors cannot be precisely defined; however, the decision errors will be minimized by inspecting and screening all properties in the Troy operable unit. Decision errors based on analytical data will be minimized by the use of standard EPA-approved and Libby-specific analytical methods.
STEP 7: Optimize the Sampling Design
• All properties in the Troy OU will be uniquely defined in the work plan, and their locations will be identified using existing Lincoln County records, cadastral databases, and low-level aerial photographs. The number of Troy properties to be investigated will be approximately 1,000. • Dust and soil samples will be collected using similar methods and standardized procedures that have been employed for the Libby Asbestos Superfund Site OU 4. With more than 4,000 Libby properties sampled since 2001, the methods have been defined (CDM 2002; CDM 2003a; CDM 2003b; EPA 2003a). • Field QA/QC procedures will be implemented and will include equipment and personnel decontamination, QA samples, field documentation, and sample chain of custody. Scientifically valid and legally defensible data will be supported by collection of dust and soil field blanks and other QA samples at a frequency necessary to assess potential cross contamination from equipment and sample integrity during collection. • Field sample data sheets, similar to those used in Libby, will be completed for each sample collected and each property inspected within the Troy OU. The field data sheet information will be recorded into the electronic Libby Asbestos Sample Tracking Information Center (eLASTIC) application for uploading to the existing Libby V2 database.

TABLE 3-1 (continued)

DATA QUALITY OBJECTIVES
INVESTIGATION OF TROY PROPERTIES

STEP 7: Optimize the Sampling Design (Continued)
• Dust and soil samples collected at each Troy property will be uniquely labeled, and sampling information will be recorded into the eLastic application. The paper sample records, along with the samples, will be transferred under chain-of-custody procedures to a CDM sample data coordinator, who will verify completeness and accuracy of the records. • DEQ and its contractor, Tetra Tech, will work closely with EPA, Volpe, and its contractor, CDM, to ensure that sample integrity is maintained throughout and that data quality is adequate to meet project objectives. • CDM will transfer the electronic sampling and field form information to EPA and Volpe and prepare the samples for analysis. • Figure 3-3 provides a schematic diagram of the TAPE process used by Tetra Tech to organize, conduct the property evaluations and sampling, and provide samples and electronic information to CDM, EPA, and Volpe.



SAMPLE COLLECTION

BUILDING INTERIOR

Inspect Building Attic for VCI → Complete field form. No sample collected in attic

↓

Inspect Each Building Level for VCI → If migrating VCI visible, sample room as SSVR

→ Collect dust samples from each building level

PROPERTY EXTERIOR

Specific Use Areas (gardens, flower beds, play areas; any areas with potentially greater exposure or greater use of amendments) → Inspect **each** Area and Collect Composite Soil Sample from **each** Area

Yards and Open Space → Inspect **all** Areas and Collect Composite Soil Sample from **each** Discrete Area of approximately 5,000 square feet.

NOTES:
VCI = Vermiculite Containing Insulation
SSVR = Small Scale Vermiculite Removal

TROY ASBESTOS PROPERTY EVALUATION
TROY, MONTANA

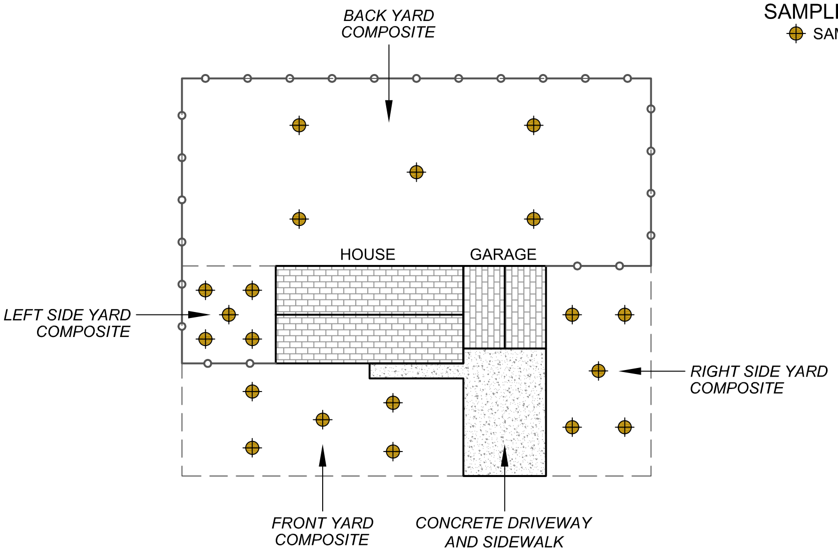
FIGURE 3-1
Tape Inputs

Tetra Tech EM Inc.

YARDS AND OPEN AREAS

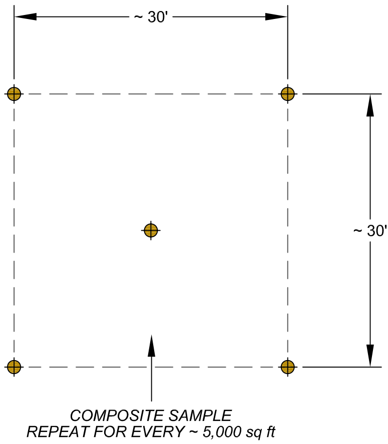
SAMPLE COLLECTION DETAILS

SAMPLE COLLECTION LOCATION



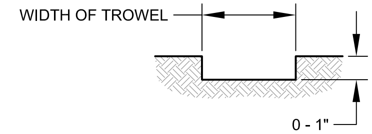
PLAN VIEW

(WITH DEFINED AREAS AND BOUNDARIES)



PLAN VIEW

(WITHOUT DEFINED AREAS AND BOUNDARIES)



SAMPLE COLLECTION SECTION

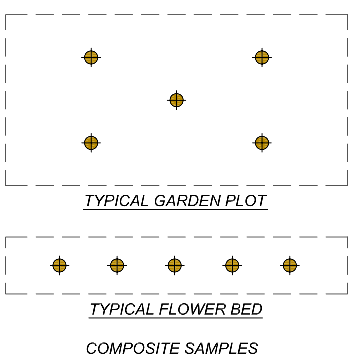
(YARD AND OPEN AREAS)

SPECIFIC USE AREAS

(GARDENS, FORMER GARDENS, FLOWER BEDS, PLAY AREAS)

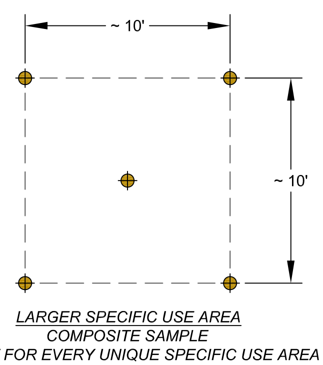
SAMPLE COLLECTION DETAILS

SAMPLE COLLECTION LOCATION



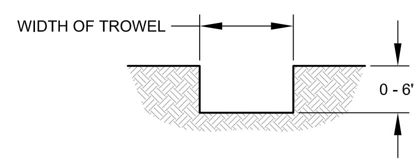
PLAN VIEW

(WITH DEFINED AREAS AND BOUNDARIES)



PLAN VIEW

(WITHOUT DEFINED AREAS AND BOUNDARIES)



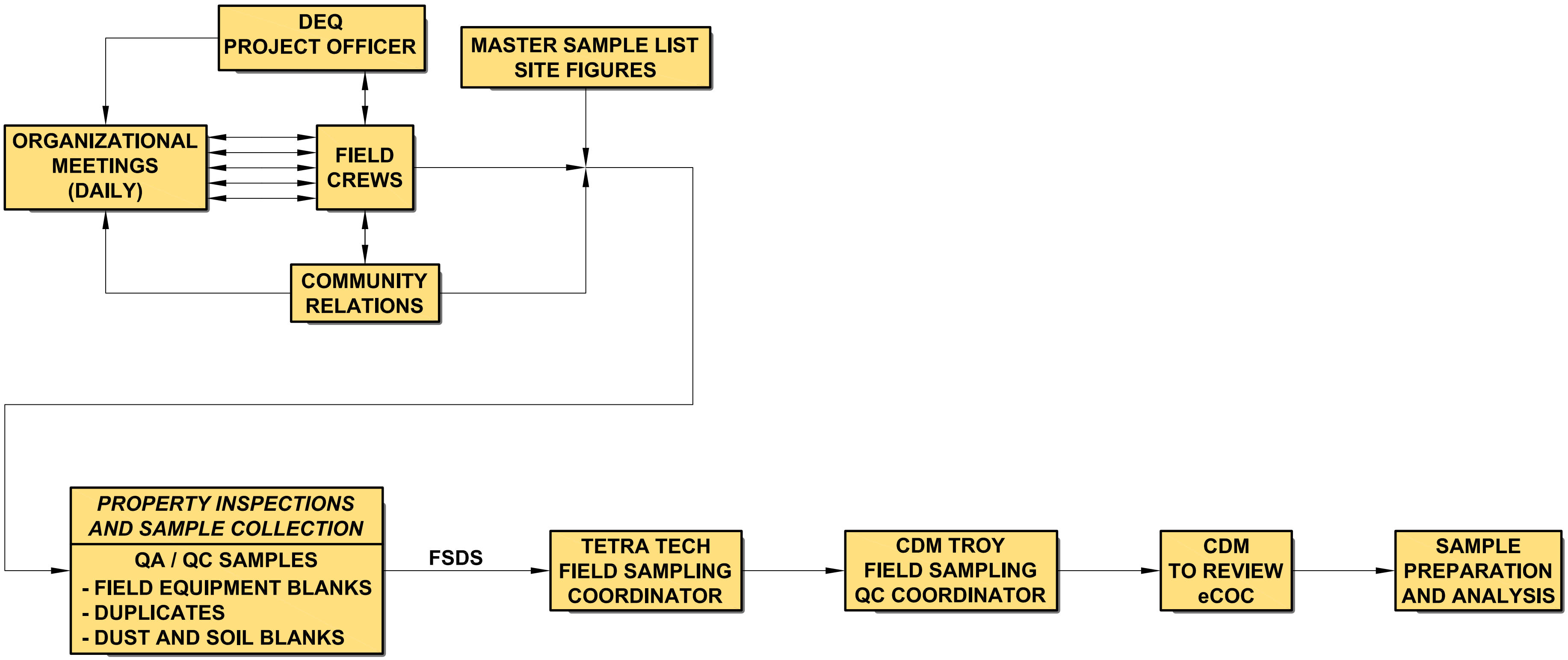
SAMPLE COLLECTION SECTION

(SPECIFIC USE AREAS)

TROY ASBESTOS PROPERTY EVALUATION
TROY, MONTANA

FIGURE 3-2
TAPE Outdoor Soil Sampling Design

Tetra Tech EM Inc.



DEQ - Montana Department of Environmental Quality

eCOC - Electronic Chain of Custody

FSDS - Field Sample Data Sheet

QA - Quality Assurance

QC - Quality Control

TROY ASBESTOS PROPERTY EVALUATION
TROY, MONTANA

FIGURE 3-3
TAPE Inspection and Sampling Process Diagram

Tetra Tech EM Inc.

FIG_3-3_Sampling Process Diagram.dwg - DWH - 02/23/2006 - S1176-41-TROYWP

4.0 FIELD PROCEDURES

This section of the TAPE Work Plan describes the field activities to be implemented for the TAPE inspection and sampling project and includes the following tasks:

- Mobilizing and demobilizing
- Obtaining access agreements
- Scheduling inspections with property owners
- Conducting verbal interviews
- Conducting property inspections – indoor, attic, outbuildings, outdoor open spaces, yards, specific use areas (using the inspection field form [IFF])
- Collecting indoor dust samples (recorded on dust sample field sampling data sheet [FSDS])
- Collecting building material samples (recorded on soil-like material sample FSDS)
- Collecting outdoor soil samples (recorded on soil-like material sample FSDS)
- Collecting QA/QC samples
- Decontaminating equipment and personnel
- Containing and disposing of investigation-derived waste

SOPs, with current amendments, are provided in Appendix B and are referenced throughout this section of the TAPE Work Plan. As appropriate, Tetra Tech has developed project-specific guidance for Troy which is based largely on guidance developed specifically for the Libby Asbestos Superfund Site. The Tetra Tech project-specific guidance and the Libby-specific procedures that were used to generate the Troy guidance documents are listed below with copies provided in Appendix B.

- Tetra Tech — TAPE FSDS and IFF Completion Guidance
- Tetra Tech — TAPE Soil Sampling Guidance
- CDM-Libby-05 — Site Specific Standard Operating Procedure for Soil Sample Collection

Health and safety protocols and requirements will apply to all field activities and are summarized below. Information on quality control is provided in Sections 5.0 and 7.0 of this TAPE Work Plan.

4.1 HEALTH AND SAFETY PROCEDURES

The TAPE HASP (Appendix A) and Tetra Tech's corporate health and safety program plan will apply to all field activities undertaken as part of this project. All field staff conducting inspection and sampling activities will be required to:

1. Hold a current OSHA hazardous waste operations (HAZWOPER) 40-hour training certification and up-to-date 8-hour refreshers, as required under 29CFR1910.120;
2. Hold a current asbestos inspector training certificate;
3. Hold a State of Montana asbestos inspector license;
4. Have medical clearance to work wearing a half-face air purifying respirator; and
5. Be quantitatively fit-tested for the specific project respirator within the 12 months prior to the field activities.

The TAPE HASP in Appendix A provides detailed health and safety protocols and requirements, including directions for when to use PPE, such as respirators. All attic entries will be conducted in modified level C PPE that will include a half-face or full-face air purifying respirator with HEPA cartridges. Other property inspection activities, including dust sampling and soil sampling, will be conducted in modified level D PPE. Mr. Joe Faubion will be the Tetra Tech Site Safety Officer for the field activities (see Table 2-1 of this TAPE Work Plan). Negative exposure assessments for the field teams will be performed as necessary, as described in the HASP and at the direction of the Site Safety Officer.

4.2 SITE ACCESS AND LOGISTICS

Section 4.2 provides information about community relations, logistics and schedules, and site access agreements.

4.2.1 Community Relations and Information Centers

Tetra Tech will coordinate with DEQ to ensure that sufficient public outreach (including public meetings, fact sheets, newspaper articles and notices, and radio announcements) is completed before and during implementation of the TAPE. Tetra Tech will provide personnel to attend public meetings in Troy and will help prepare presentation materials, at DEQ's request. Public outreach and information on the purpose and nature of the TAPE and its role in the overall investigations and cleanup at Troy and Libby are essential to its success.

Tetra Tech and DEQ will set up and staff a field office in Troy at least 1 month before and for the duration of TAPE field activities. The Tetra Tech field office will be the TAPE logistical center for obtaining property access agreements, scheduling field activities, returning samples and field forms at the end of the day, and transferring sample custody from Tetra Tech to CDM. The Tetra Tech field office will also provide a physical location and venue for people in Troy to provide and obtain information about the project. The Tetra Tech field office will also have telephones and answering machines for contacting project personnel when the office is not staffed and after regular hours (Monday through Friday 8:00 am to 5:00 pm). The address and phone number for the Tetra Tech field office will be advertised and posted at the location.

The existing EPA Information Center at 501 Mineral Ave in Libby will also be an information resource for Troy residents, providing access to major project documents. Troy area residents may phone the information center toll free at 1-888-420-6810 or visit the center Monday through Friday from 8:30 a.m. to 5:00 p.m.

DEQ has established a repository for general and Troy-specific information at the City Hall in Troy, located at 301 E. Kootenai. The Troy City Hall is open Monday through Friday from 8:00 a.m. to 5:00 p.m. Tetra Tech and DEQ will continue to provide updated information in City Hall throughout the field sampling activities.

Information about the Libby Asbestos Superfund Site is also available on the Internet at <http://www.epa.gov/region8/superfund/libby.html>. DEQ will maintain updated information regarding Troy on this webpage.

Section 2.0 of this Work Plan discusses the roles and responsibilities of the DEQ and Tetra Tech in community relations.

4.2.2 Logistics and Schedule

Tetra Tech will establish a field office in Troy for the duration of TAPE field activities. Tetra Tech will identify and provide all necessary personnel, sampling equipment, PPE, and project materials for implementing this Work Plan. All Tetra Tech field personnel will be trained not only in specific tasks but also on the overall objectives of the TAPE. This training will facilitate TAPE implementation and allow for effective communication with the public and other team members.

Tetra Tech personnel will include the TAPE project manager, who will oversee all project activities and logistics and will ensure that the lines of communication are maintained to resolve any issues or concerns that may arise during the field efforts. The Tetra Tech project manager will reside in Helena but will be at the project site in Troy for about 50 percent of the field activities. The TAPE field team leader will be based out of Troy and will be responsible for obtaining site access agreements, assisting with public outreach, scheduling daily field activities, and providing quality control and oversight of the five TAPE field teams. Tetra Tech will also provide a field data coordinator to reside in Troy and assist the project manager and field team leader with daily project tasks. The Tetra Tech Field Data Coordinator will have primary responsibility for checking and cataloging soil and dust samples at the end of each day and for working closely with the CDM Troy Sample Coordinator to ensure that complete, adequate, and secure sample information is collected and transferred to EPA. The detailed responsibilities for these Tetra Tech project personnel are further discussed in Section 5.5.

Tetra Tech will provide five two-person TAPE field teams stationed in Troy for the duration of the field effort. Some substitution and rotation of field staff on and off the TAPE project is expected, but the field staff will work a minimum of 2 weeks before substitutions occur. The Tetra Tech field team leader (Mr. Stockwell) will continuously accompany the field teams to ensure and verify that the teams are conducting the TAPE activities as described and outlined in this Work Plan. The Tetra Tech field teams may conduct limited TAPE inspections on weekends (both Saturday and Sunday) to better accommodate the schedules of Troy property owners. Both members of a field team will be HAZWOPER certified, hold current asbestos inspector licenses, and be trained to properly handle the health and safety protocols for this project.

On average, a Tetra Tech field team will complete three TAPE inspections per day, depending on the complexity of the properties inspected. With five field teams, Tetra Tech can complete an average of 15 total TAPE inspections per full day. If the field inspections continue uninterrupted, Tetra Tech could complete the inspections of more than 1,000 Troy properties in about 75 full work days, or within a 15 week time frame. Tetra Tech's projected schedule for completing the TAPE inspections will be finalized when DEQ receives adequate EPA funding.

4.2.2.1 Communications

Field team members will be provided with cell phones (which will necessitate use of a temporary cell tower), satellite phones, or multi-way radios for the duration of field activities. Contact information, including emergency numbers, for all field teams and for TAPE project management personnel in Helena, Montana, will be stored in the Tetra Tech Troy field office. In addition, the Montana DEQ TAPE Project Officer (Ms. Catherine LeCours), CDM Troy Sample Coordinator, and EPA Libby Asbestos Superfund Site personnel will be provided with contact information for ready access to the Tetra Tech field teams.

4.2.2.2 Equipment

Appendix C details equipment and supplies Tetra Tech identified as necessary for the TAPE field activities described in this Work Plan. Equipment and supplies that are not immediately available to Tetra Tech will be purchased or rented before TAPE field activities begin. Before purchased or rental equipment or supplies will be accepted, the Tetra Tech field team manager will inspect the goods to ensure they are in good condition and free of defects.

4.2.2.3 Pre-Field Activities

Before field crews mobilize to Troy for the TAPE field inspections, Tetra Tech will prepare detailed property maps that identify individual Troy properties. Property boundary and other details will be gathered from public databases (cadastral) and projected onto a high-quality, high-resolution air photograph. Individual Troy property maps will be used during the TAPE field inspections to record approximate locations of the specific use areas and yard samples collected at each property. These property maps will be field checked and may be revised as necessary during the inspections. Tentative inspection and sampling schedules may be based on a block-by-block TAPE inspection pattern. The TAPE inspection schedule will be refined as Tetra Tech schedules the inspections at times and dates convenient to the property owners.

4.2.2.4 Field Team Organization

Five field teams of two people per team will conduct the TAPE inspections and sampling. On average, 15 properties will be inspected and sampled per day. At the start of each day, the field teams will meet at the

Tetra Tech field office for daily safety and organizational briefings (see Section 4.1 and Appendix A HASP).

Before the morning briefing, the Tetra Tech field team leader will have prepared a packet for each property to be inspected and sampled that day. Each packet will include:

- A copy of the signed access agreement or blank access agreement if occupant provided prior verbal agreement,
- Details of the scheduled inspection date and time, and the name and telephone number of the property owner or the person who will be present for inspection and sampling, if different than the property owner,
- A property-specific verbal interview form,
- A property-specific IFF,
- A property-specific FSDS,
- Preprinted property-specific property, building, sample point, and sample identification labels, and
- Two copies of the property parcel maps.

Each field team will have a numbered logbook specific for the Troy project and will be responsible for any additional information included in the logbook. Additional TAPE inspection and sampling supplies (as described in Appendix C, list of supplies) will be kept at the Tetra Tech field office for use by the field teams. The daily briefings will be used to coordinate daily property inspections, calibrate sampling equipment, and collect supplies. The daily briefing will include a review of any issues or problems that arose the previous day, and will provide an opportunity for field team members to ask questions and share lessons learned. At the end of each day, field teams will return to the field office to deliver samples and paperwork to the Tetra Tech Field Data Coordinator, download digital cameras, charge rechargeable equipment, and store field equipment for the evening. Section 6.0 of this Work Plan contains additional logistical details on TAPE data management.

4.2.3 Access Agreements

Approximately 1 month before TAPE field activities begin, Tetra Tech will assist DEQ with mailing access agreements to every Troy property owner where the property has been identified for inspection and sampling. A cover letter will contain information from DEQ on the proposed sampling and contact information for Tetra Tech Troy field office, DEQ, EPA, and the Libby Information Center. The packet will also contain two copies of an access agreement form and a postage-paid envelope for the property owners to return a completed access agreement. The other copy of the access agreement is for the property owner's records. The cover letter will explain the need for the signed access agreement and encourage any property owners who have questions or concerns about the process to contact the designated parties. An example cover letter and access agreement is provided in Appendix D.

The Tetra Tech project manager and field team leader will manage information mailed in from the Troy property owners, including signed access agreements. Approximately one month after DEQ and Tetra Tech mail the access agreements, a field team of two Tetra Tech personnel will follow up with properties where no response has been received. Follow up contacts (in person or by telephone) will explain the purpose of the TAPE, describe the inspection and sampling process, and answer any pertinent questions. Property owners may provide verbal approval and schedule an inspection; therefore, field teams may obtain a signed access agreement immediately prior to a scheduled inspection.

If property owners are not available during the reconnaissance, the field team will revisit each location at least three times, and the field team leader (or designee) will continue to follow up with personal visits and by telephone. After repeated attempts to contact the property owner by the field teams and the field team leader, Tetra Tech will repeat the mailing with a letter describing the attempts made to contact the property owner.

When the field team leader has received either verbal approval or a completed and signed access agreement either by mail or from a field team, Tetra Tech will contact the property owner by telephone to schedule a TAPE inspection and sampling visit.

Tetra Tech will make reasonable efforts to find a TAPE inspection and sampling date and time that are convenient for the property owner. TAPE inspections and sampling schedules will include evenings (daylight hours only) and weekends, as needed based on the requests of property owners. If property owners respond to the access agreement favorably, but a property is currently uninhabited (for example, it is only seasonally occupied or is currently for sale, or no buildings are present on the property), Tetra Tech will attempt to inspect and sample the property with a designee of the property owner. Properties will not be exempted from inspection or sampling on the basis that they are currently uninhabited, however.

Tetra Tech will not advise property owners of the likely nature of removals at their properties or estimated removal dates during the TAPE scheduling phase, the personal interviews, or the TAPE inspections and sampling. Property owners will be advised that DEQ and EPA will determine removals and schedules after analytical results have been received and evaluated.

Some Troy property owners may be non-responsive or unwilling to sign an access agreement, even when Tetra Tech has attempted to contact them by all reasonable means (telephone, visit to the property, and repeated mailings) to obtain permission for a TAPE inspection and sampling. Tetra Tech will provide DEQ with a list of all Troy properties where the property owner could not be contacted or unwilling to sign an access agreement at the conclusion of TAPE field activities.

4.3 VERBAL INTERVIEW

The Troy property visit by the TAPE field team will commence with a verbal interview by the field team with the property owner to acquire background information about the property. The field team will interview the property owner using the questions provided on the Interview for Residents/Employees form (Appendix E). Interview topics will include the known or suspected use of VCI or other LA-containing building materials in the house or outbuildings and possible introduction of other sources of LA within or near the property (including garden and landscaped areas and neighboring properties). A unique property identification number (AD-XXXXXX) will be assigned to each individual property that is inspected.

All buildings encountered during the TAPE inspections will be classified as a primary structure (habitable building, for example, a house, apartment, or main commercial space); or a secondary structure (non-habitable building, such as garages, shops, sheds, barns, or dog houses). The verbal interview will address all primary and secondary buildings and special use, open space, and yard areas located on a Troy property.

4.4 BUILDING INSPECTION, SAMPLE COLLECTION, AND RECORDING PROCEDURES

This section describes the inspection, sampling, and recording to be completed for each TAPE inspection.

4.4.1 Indoor Inspection

The two-person field team will visually inspect each building for the presence of LA contamination. One team member will access and inspect the attic (if safe, present, and reasonably accessible) and will inspect additional areas where VCI may be exposed in living spaces (crawlspaces, closets, and any wall openings). If VCI is observed, the field team member will estimate the quantity based on field measurements or visual estimation, with field measurements (length, width, and height of item) collected wherever possible.

The second team member will document results, including estimated quantities of VCI and other insulation (if present), on the IFF and will record additional pertinent information in the field logbook. As much as is possible in a non-destructive manner, the visual inspection will include checking under other types of insulation (such as blown-in or fiberglass insulation) for VCI. Visual inspections will not involve opening up walls or ductwork to inspect for VCI within the building wall cavities, but will include removal of a representative sample of electrical switch plates to inspect wall interiors. Furthermore, it will include inspecting ductwork in accessible, unfinished areas of the building for VCI. In particular, the field team will note whether utility conduits (including heat/cooling vents) run from the attic to the living space. Visual inspections will not include inspecting the roof.

Attics will be considered reasonably accessible if they can be reached by stairs, hanging stairs, or a non-conductive stepladder (either from the interior or exterior of the building). Attics will be inspected in a manner that, in the judgment of the field team, is not likely to release additional VCI into the living space (exterior access is preferable). The field team will compare exterior roof lines and interior ceiling heights with attic interiors in an effort to identify isolated attic areas that may exist between the roof and the main attic, or between the attic and the interior ceilings. If isolated attics are found, they will be inspected if possible, and barriers between attic areas and access points will be described in the IFF. Attic inspections will also involve inspection of kneewalls (areas where the pitch of the roofline meets the walls). Kneewalls may be used for storage or to improve the finished look of an attic. Kneewalls will be accessed wherever possible, as these areas may provide additional information on construction material. (For example, kneewalls may have unfinished floors compared with the finished floors in the rest of the attic.) If trusses or bracing posts are present in the attic that may pose an obstacle to potential cleanup, these items will be briefly described in the inspection form.

As detailed in the HASP, decontamination zones will be established during the TAPE project, such as at the base of ladders used to access attic spaces or outside of crawl space entrances. These areas will be covered with two layers of polyethylene sheeting during sampling in the attic or crawl space. After personal and equipment decontamination are complete and polyethylene sheeting removed, decontamination areas will be cleaned of debris and residue using appropriate HEPA vacuuming or wet cleaning procedures. Visitors, including building occupants, will not be permitted to enter the decontamination zone without proper qualifications and authorization.

If potted plants are located inside the primary building, the field teams will note whether vermiculite-containing potting soil is present, as this type of soil could affect results of dust sampling.

As described in the HASP (Appendix A), the field team will not be required to access any attics, crawl spaces, or living areas if there is an unacceptable safety hazard, including biological hazards. The field team will not inspect Troy properties for non-VCI and non-LA asbestos. However, damaged or friable suspect asbestos-containing materials that are observed in the inspection will be noted in the field notebook. This information may be of use in interpreting sampling results and planning potential remediation efforts.

The field team may choose to photo-document specific conditions in the building during the TAPE inspection for future reference. The property owner will be asked for permission before any photographs are taken.

TAPE inspections will be documented on IFFs (Appendix E) and in the field logbooks. Pertinent details will include, but are not limited to, identifying the primary and secondary buildings, defining attic spaces, and sketching on the detailed property maps.

As described in Section 4.3, buildings on a property will be classified as primary or secondary. Every primary and secondary building will be subject to a TAPE inspection, an IFF will be completed, and samples collected.

4.4.1.1 Record Building Locations with GPS

As part of the TAPE inspection, the location of each primary and secondary building on the property will be recorded using the backpack-mounted Trimble XRS-Pro global positioning system (GPS). The GPS location will be recorded at the primary entrance to each building. In addition, the building's primary entrance will be clearly marked on the building visible on the aerial photograph along with the corresponding building ID number (recorded directly on the building on the photograph. Coordinates will be saved on the GPS with a unique identification number that starts with the notation "BD-XXXXXX," where "BD" indicates a building location, and will also be recorded by the field team on the IFF, at the primary entrance to the building on the air photograph (for buildings shown), and in the field logbook.

4.4.2 Indoor Dust Sampling

Dust samples will be collected using microvacuum (microvac) sampling techniques in all primary buildings, regardless of whether VCI or other LA-containing building materials are observed. Asbestos is not visible to the unaided eye and not all sources (historical or current) may be identified through the verbal interview or during visual inspection, therefore, dust samples are collected at all properties. Dust samples will be collected following the procedures provided in American Society for Testing and Materials (ASTM) *Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations* (D 5755-95), as amended for the Libby Asbestos Superfund Site. A copy of this standard ASTM method is provided in Appendix B, with site-specific applications described below (ASTM 1995).

The decision to use microvac sampling, rather than wipe sampling, for the TAPE inspection and sampling was based primarily on the need to collect data that are consistent with data collected for the Libby Asbestos Superfund Site. EPA, and its contractor CDM, have used microvac sampling methods to collect the indoor dust samples in Libby. Microvac sampling methods are assumed to collect samples that more accurately measure releasable asbestos fibers when compared with wipe samples. Each indoor dust sample will be composed of a three-point composite sample, as described in the above-mentioned ASTM standard (ASTM 1995), as amended.

4.4.2.1 Select Sampling Locations

The TAPE field team will select sample locations based on the team's visual inspection of the buildings and estimation of where contaminated dust is most likely to be found. The number and locations of dust samples will be selected as described below.

Primary and Secondary Buildings

Dust samples will be collected in every primary and secondary building regardless of whether LA contamination was observed during the visual inspection.

- Two dust samples will be collected on each level of the building's living space (including finished basements):
  - One three-point composite sample will be collected from accessible horizontal surfaces (for example, windowsill, shelving, and cabinets). The TAPE field team will select the surface or surfaces based on factors including proximity to observed VCI and dust accumulation. (Preference will be given to surfaces with higher dust accumulation that are closer to observed VCI.)
  - One three-point composite sample will be collected from high-traffic walkways, which will be selected by the TAPE field team based on the most probably walkway for tracking contamination into the building, including walkways adjacent to entry doors on the main floor. It will include main walkways and corridors between living areas on upper floors and in basements without walk-out access. Walkways may be solid surfaces or covered with rugs and carpets, or a combination. Samples will not be collected from temporary floor coverings that may be routinely cleaned or discarded.
- One three-point composite sample will be collected from each unfinished basement, if present. This sample will be collected from both walkways and horizontal surfaces inside the basement, with specific aliquots selected at the discretion of the TAPE field team.
- One three-point composite sample will be collected from each attached garage or shop, if present. This sample will be collected from both high-traffic walkways and horizontal surfaces inside the attached building, with specific aliquots selected at the discretion of the TAPE field team.
- No dust samples will be collected in attics or crawlspaces with visible LA contamination. Based on extensive sampling and analytical results from the Libby Asbestos Superfund Site, VCI found in attics and crawlspaces is assumed to be contaminated with LA fibers (EPA 2003b).
- The field team may choose to collect additional, targeted dust samples if migrating VCI is observed in the living space of a primary structure. These data would be used to design small scale vermiculite removal actions if necessary.

4.4.2.2 Dust Sample Collection

Collecting a microvac dust sample involves vacuuming dust from a surface and drawing the sample through a filter designed to capture particulates larger than 0.45 micrometers (μm). The ASTM method D5755-95, as amended for the Libby Asbestos Superfund Site, provides the procedural details for properly collecting a microvac dust sample (Appendix B, ASTM 1995).

The microvac device will consist of a battery-operated low-volume sampling pump connected to a 25-millimeter (mm) vacuum dust sampler cassette. The analytical laboratory will provide the cassettes and tubing. The cassettes will contain a 0.45-μm mixed cellulose ester filter. A 6.35-mm diameter plastic tubing will be used to connect the cassette to the pump. A 25- to 37.5-mm length of 6.35-mm diameter tubing will be used to create a "nozzle" on the cassette for sampling. The nozzle tubing will be cut at the sampling end at an approximate 45-degree angle.

The pump will be calibrated each morning in the Tetra Tech field office using a standard calibration device such as a Dry-Cal. The pump will be calibrated using a 25-mm vacuum dust sampler cassette to simulate field operation. The flow rate used for sampling will be approximately 2 liters per minute, which provides an approximate air velocity of 100 centimeters per second through the 6.35-mm diameter tubing. The field teams will be equipped with one back-up pump to ensure proper operation and may return to the field office for recalibration as necessary.

The sampling area for each dust sample point (aliquot) will be 100 square centimeters (cm^2) delineated using a fixed template provided with the sampling cassettes. The aliquot sample will be collected by activating the pump and passing the angled nozzle across the delineated surface for 2 minutes.

Each indoor dust sample will contain three sample aliquots; that is, three separate 100 cm^2 surfaces will be vacuumed using one cassette. The cassette will therefore contain dust from a total 300 cm^2 surface area. To collect aliquots, the pump will be turned off and the sampling device moved to the next sample point. Once the next aliquot area has been delineated using a template, the pump will be turned on and the next 100 cm^2 surface area will be vacuumed. When all three sample aliquots have been collected, the sampling device will be turned upside down so that any loose dust falls into the cassette. The exterior of the cassette and nozzle will be wiped clean with a wet towel (wet wipe). The cassette will be detached from the pump, the cap returned to the cassette, and the cassette and the nozzle will be placed in a re-closable plastic bag for shipment to the laboratory (see Appendix B for detail). The nozzle will be included in the shipment because significant quantities of dust can remain in the nozzle. The sample will be labeled using the pre-printed sample labels and will be wrapped for return to the Tetra Tech field office. Dust samples will be labeled with a unique sample identification number "TT-XXXXX" where "TT" indicates a "Troy TAPE" sample. Chain-of-custody procedures will be followed as described in Section 5.5.2.

Indoor dust sample point locations will be described and recorded in the TAPE field logbook and on the FSDS and may be photographed and sketched on the property map at the discretion of the field team.

4.4.3 Building Materials Sample Collection

The TAPE field team may encounter some building materials (for example, chinking between log in log homes, special concrete with vermiculite added, and lathe and plaster walls) that include vermiculite. These special building materials, when encountered, will be sampled (with as little disturbance as possible to the building's finish) and information recorded in the logbook and on a soil-like materials FSDS. The building material samples will be labeled with a unique sample identification number "TT-XXXXX", where "TT" indicates a "Troy TAPE" sample.

Sampling of building materials will follow EPA guidance document 560/5-85-030A and ASTM Standard E2356-04 (see Appendix B), including the number of samples to be collected from each type of building material. The area to be sampled will be wetted down using surfactant-enhanced water prior to and during sampling to minimize potential asbestos fiber release. After sampling, the field team will use spray-on sealant and/or tape to encapsulate the material sampled if necessary.

As detailed in the HASP, decontamination zones will be established including areas around building material sampling activities. After personal and equipment decontamination are complete, decontamination areas will be cleaned of debris and residue using appropriate HEPA vacuuming or wet cleaning procedures. Visitors, including building occupants, will not be permitted to enter the decontamination zone without proper qualifications and authorization.

4.4.4 Outdoor Inspection

All areas of the Troy properties that are not covered with buildings will be inspected for vermiculite product in soil and surface materials. The areas of the Troy properties that are not covered by buildings will be grouped into two general types: (1) outdoor yards and open space, and (2) specific use areas. Figure 3-2 provides typical outdoor soil sampling designs for these two general types of outdoor areas.

Special attention will be paid to areas where known sources of LA may have been introduced (including fill areas) and to "high traffic areas" where potential LA is likely to be tracked indoors. The TAPE field team may further subdivide the outdoor yards and open space by land use types, such as yards or grassy areas; driveways; parking areas, and filled areas, if known or visible. Sketches will be drawn on the individual property maps to show the separate land use areas. The property sketch will also show fences, large trees, or other potential obstructions to potential future remediation. Properties that do not have yards, such as commercial properties, will be described as such on the IFF and in the field logbooks; outdoor areas such as paved parking or driveways will still be inspected. As best identified by the property owner, property boundary lines will also be noted on the IFF.

One member of the TAPE field team will visually inspect each area for the presence of vermiculite product or LA-containing rock while the second team member documents the locations and estimated quantities of observed vermiculite product on the IFF and in the field logbook. Locations of vermiculite product observed will also be sketched on the property map. Visual outdoor property inspections will not include digging below the soil surface or destructive techniques to investigate underneath asphalt or concrete. It will not be necessary to delineate the vertical extent of contamination because the default excavation depth for remediation of specific use areas is 18 inches below ground surface (EPA 2003b). Similarly, the default excavation depth for remediation of general yard areas, open space, and driveways is 12 inches below ground surface (EPA 2003b).

Specific use areas include current and former flower beds, current or former gardens, planters, compost piles, play areas, gravel or dirt driveways, and stockpiles. These areas will be included in the inspection. Visual inspections of specific use areas will include limited digging below the soil surface with the least disturbance possible.

The field team may elect to photo-document specific conditions on the property for future reference. The property owner will be asked for permission before photographs are taken.

4.4.5 Outdoor Soil Sampling

After the visual inspection of the property has been conducted, the TAPE field team will collect soil samples from special use and yard areas following the procedures described below and in the Tetra Tech's project-specific guidance (Appendix B). Soil will be sampled regardless of the results of the visual inspection. Soil sampling will include the following steps:

- Identify sampling locations
- Collect samples
- Record locations on Troy property map
- Record sample locations using GPS

4.4.5.1 Identify Sampling Locations

TAPE soil samples will be collected as five-point composites with composite subsamples taken from similar use areas. Typical designs for outdoor soil sampling are shown graphically on Figure 3-2. It can be assumed that LA sources would have been distributed across an area, for example by tilling into a yard or garden. A minimum of one five-point composite soil sample will be collected at each Troy property, unless the property has no soil-covered areas (for example, all outdoor areas are paved). A five-point composite will also be collected from the specific use areas; however, the size and dimensions of the specific use area may require that less than five subsamples be collected for some specific use areas. At least one five-point composite sample will be collected from the yard area. In general, five-point composite samples will not cover more than approximately 5,000 square feet. A maximum of five, five-point composite samples will be collected at each property, but additional composite or grab samples may be collected at the discretion of the TAPE field team. The TAPE field team will use professional judgment to select the appropriate numbers of soil samples to collect at each property. In addition, the TAPE field team will collect all soil samples with the minimum amount of disturbance to the surface. Sod will be carefully removed and immediately replaced after sampling and care will be taken to collect soil samples without disturbing growing flowers and vegetables. To ensure consistency, all TAPE field teams will be provided the same training and guidelines, and training will include "brainstorming" potential property scenarios and discussing proposed sampling approaches.

4.4.5.2 Collect Soil Samples

Soil samples will be collected from (1) outdoor yards and open spaces, and (2) specific use areas at properties in the Troy OU. Figure 3-2 provides typical outdoor soil sampling designs for these two types of outdoor areas.

A typical Troy yard sample will be composed of a five-point composite soil sample collected from the 0 to 1 inch depth. As shown in Figure 3-2, the five individual sample points that will make up each composite sample will be located within a similar land use area, such as the back yard, front yard, or side yard. A minimum of one five-point composite sample will be collected from each Troy OU property with a yard. Additional five-point composite samples will be collected when the yards are larger than 5,000 square feet.

A typical open space sample will also be composed of a five-point composite soil sample, as shown on Figure 3-2, collected from the 0 to 1 inch depth. Typical spacing for the individual five-point locations are shown as approximately 30 feet, but this distance can be modified to best fit the land use area. Additional five-point composite samples will be collected for each open space area of approximately 5,000 square feet. The Tetra Tech field team will use professional judgment to select the appropriate number and type of soil samples to collect for each yard and open space. Not all open spaces may be sampled, depending on current and historical uses. To ensure consistency, all field teams will be provided the same training and guidelines, and training will include "brainstorming" potential property scenarios and discussing proposed sampling approaches.

Specific use areas in Troy include outdoor gardens, former gardens, flower-beds, play areas, gravel or dirt driveways, and other areas with potentially greater exposure or greater use of vermiculite amendments. Five-point composite soil samples will be collected from the 0 to 6 inch depth interval in specific use areas. Figure 3-2 presents typical layouts for a garden plot, flower bed, and undefined areas. Typical sample spacing shown on Figure 3-2 is for 10 feet separation, but the distance can be modified to best fit the specific use area. The TAPE field teams will be provided training and guidelines for consistent sampling of specific use areas.

Disposable hand trowels will be used to collect approximately 500 grams of soil sample from the 0 to 1 inch or 0 to 6 inch soil interval at each subsample location for a total of approximately 2.5 kg of soil. If a small metal shovel is required to assist with sampling to 6 inches, the shovel will be thoroughly cleaned and decontaminated after each sample using procedures outlined in Section 5.1. Subsamples will be placed into one re-closable plastic bag and mixed. During sample collection and mixing, the field team will attempt to shield the soil samples from the wind to avoid potentially losing lighter fractions of the soil to the ambient air.

The initial re-closable plastic bag will be placed inside a second bag as a precaution. A pre-printed sample label will be affixed to the outside of the inner re-closable bag as well as the sample ID number written on the outside of the inner bag. The outer re-closable plastic bag will also be labeled and marked similarly using the pre-printed sample ID numbers. Soil samples will be labeled with a unique sample identification number "TT-XXXXX" where "TT" indicates a "Troy TAPE" sample. Chain-of-custody procedures will be followed as described in Section 5.5.2.

The TAPE field team will attempt to restore the land surface to its prior condition after sampling, but Tetra Tech will not be responsible for re-laying sod or replanting. For most sample locations, the small area can be replaced with soil from immediately surrounding the excavation and lightly tamped down. In addition, each TAPE field team will have some commercially-available potting soil or quality topsoil available to repair any small excavations that cannot be easily filled with nearby soil materials. It is not envisioned that sampling will require large-scale disturbance of yards, since the sample size required is small.

4.4.5.3 Record Sample Location on Troy Property Map and with GPS

The field team will mark each soil subsample location on the Troy property map with labeling to indicate the composite sample for which the subsample was collected. A backpack-mounted Trimble XRS-Pro GPS will be used to record the midpoint subsample location for each composite soil sample. The GPS location coordinates will be recorded on the GPS unit with a unique identification number that corresponds with the sample point identification number “SP-XXXXXX.” The GPS coordinates will also be recorded in the FSDS and field logbook for backup and verification of sample locations.

4.4.6 Photography

Each TAPE field team will have a camera for photo-documenting the conditions at a property, if the conditions are not readily described in writing or if, in the judgment of the field team, photographs may assist in development of a remedial action plan for that property. Permission from the property owner will be obtained before any photograph is taken, other than for photographs taken from the public right-of-way.

All photographs will be recorded in the field logbook and on the IFF, and on the property map using the following symbol to indicate the position where the photograph was taken and the direction it was taken (•→). No accurate distance scales will be used for landscape photographs, but general distances can be estimated by noting the location where the photograph was taken. All photographs will be taken using digital cameras and will be downloaded the same day at the Troy Tetra Tech field office and saved onto CD. Photographs will be saved using unique, property-specific IDs. Photographs from each property will be saved into electronic folders that are identified using the property ID number corresponding to the property ID number used in logbooks and on IFFs. Hard copies of digital photographs will not be generated as part of the TAPE but will be available upon request.

5.0 FIELD QUALITY CONTROL PROCEDURES

Section 5.0 describes the methods and procedures for decontamination, quality assurance samples, field documentation, handling investigation-derived wastes, and maintaining chain of custody of samples and records.

5.1 EQUIPMENT AND PERSONNEL DECONTAMINATION

Dust samples will be collected using laboratory-provided filter cassettes with a new cassette and template for each sample collected. The air pump will not require decontamination between samples as a matter of course because of its position behind the sample filter during sample collection. If the exterior of the air pump becomes visibly dusty, it will be wiped clean with a damp paper towel to avoid transferring dust from one location to another.

Disposable scoops and individual sample collection bags will be used for soil and building material sampling; therefore decontamination of the equipment that is in touch with the soil is not necessary. If a small metal shovel is required to assist with sampling to 6 inches in hard, compacted soils, the shovel will be thoroughly cleaned and decontaminated after each sample using a spray bottle with distilled water and paper towels.

Visible soil on hands or clothing will be removed by washing with soap and water. Additional personnel decontamination procedures, including requirements for decontamination zones, are described in Section 9.2 of the HASP (Appendix A). PPE will include disposable gloves, disposable protective outerwear, work boots, and respirators. The respirators will be cleaned and decontaminated as discussed in the HASP (Appendix A).

5.2 QUALITY ASSURANCE SAMPLES

Field blank dust samples will be collected at a frequency of one blank sample per 20 samples, or at 5 percent. Field blank dust samples will be collected at locations selected by the TAPE field team, and will be collected by attaching a cassette to the pump and pumping for 1 minute at the same rate as for dust sample collection. However, the cassette will not have a nozzle, and the end of the cassette will be exposed to indoor air at the selected sampling location, rather than passed over a surface of any kind. Data for the field blank dust samples will be evaluated to assess whether a potential exists for airborne asbestos to cause analytical detections of asbestos in dust, or for cross-contamination to occur during sampling.

Dust lot blank samples will also be submitted to the laboratory for each lot or batch of cassettes received from the laboratory. Data for dust lot blank samples will be used to evaluate whether cartridges were received asbestos-free from the laboratory. Tetra Tech will not use a cassette from a given lot until the dust lot blank results confirm the cartridges are asbestos-free.

Soil field equipment blanks will be collected at a rate of one per calendar week (Monday through Sunday) of sampling per field team. Field equipment blanks will be collected by placing silica sand (that is `asbestos-free as analyzed by polarized light microscopy [PLM]) in a re-closable plastic bag, mixing it with a disposable trowel, and submitted for analysis following the same PLM methods. Data from field equipment blank samples will be used to evaluate whether the disposable equipment is asbestos-free.

Field equipment blanks are sent to the EMSL Laboratory located in Libby for analysis by method PLM-9002. In addition, during the initial portion of the field work, at least two dust samples per team will be sent to the EMSL Laboratory for rapid analysis. These samples will confirm the field team members are using proper dust sampling techniques.

Soil field duplicate samples will be collected at a frequency of one sample per 20 composite soil samples or a rate of 5 percent. Field duplicate samples will be collected as samples collocated in the same land use area (yard or landscaped area, for example) and will contain the same number of subsamples (typically five), but will be collected from different subsample locations. Data for soil field duplicates will be used to evaluate the potential variability in LA concentrations in a specific land use area. These data will not be used to evaluate precision in sampling or analytical techniques.

All quality assurance samples will be submitted "blind" (labeled as a collected sample) to the laboratory.

5.3 FIELD DOCUMENTATION

Example field forms (interview forms, IFFs, and FSDS) are provided in Appendix E. Before the TAPE field activities begin, all members of the Tetra Tech field team will receive the same training on implementation of this Work Plan in general and on use of these forms in particular. Property owner interviews, property inspections, and sample collections will be conducted using these forms to ensure consistency between properties and between TAPE field teams. Use of these forms will also allow compilation of TAPE-derived data into the Libby V2 database (see Section 5.5).

Any additional information that is not recorded on field forms will be recorded in the TAPE field logbooks. Each field team will maintain a field logbook for recording the date and time of each property inspection, the names of the people who allowed property access and completed the interview, the property ID and building ID numbers, the number and type of samples collected at the property including sample ID numbers and FSDS numbers, and any other pertinent information. A new page will be started in the field logbook for each property. The field logbook will serve as an independent (backup) record for all activities conducted and samples collected at a property, in the event that IFFs or FSDSs are lost or damaged. The field logbook will also be used to record additional observations of the field team that relate to potential remedial action at a property, such as locations, quantities and types of suspect asbestos-containing material that is not VCI or LA, and access limitations that were not noted on the IFF.

Information will also be recorded on the individual property maps by sketching directly onto the property maps, which will have an aerial photograph base. Property map sketches will show the locations of any observed VCI and LA-containing rock, primary and secondary buildings and the main entrance of each building, and the outdoor sample (including subsample) locations.

5.4 CONTAINMENT AND DISPOSAL OF INVESTIGATION-DERIVED WASTE

Investigation-derived waste will include used wet wipes, wet paper towels, disposable gloves, used respirator cartridges, used plastic tubing, decontamination water, disposable protective outerwear, plastic floor coverings, and other minimal waste. It is possible, but not likely, that these investigation-derived waste materials may contain some asbestos. Therefore, all investigation-derived waste will be double-bagged in appropriate asbestos bags, labeled with asbestos labels, and stored in approved containment at the Tetra Tech field office until it can be properly disposed of at an approved landfill (Lincoln County outside of Libby). Non-sampling waste generated by the TAPE field teams, such as food containers and waste paper, will be separately bagged and disposed of as solid waste at a solid waste landfill.

5.5 RECORD KEEPING AND CHAIN OF CUSTODY

At the end of each day, or more often if required, the TAPE field teams will return to the Troy Tetra Tech field office to transfer the dust, building material, soil, and QC samples; the IFFs, interview forms, and

FSDSs; and copies of the appropriate logbook pages to the Tetra Tech sample coordinator (or the coordinator's designee). All verbal interview forms, IFFs, and FSDSs will be compiled at the Troy field office, photocopied, and the original copies forwarded to the Tetra Tech office in Helena, Montana with a duplicate set of copies forwarded to Volpe on a weekly basis. An individual file will be maintained for each property inspected. Photocopies of all field forms and appropriate logbook pages in each individual property file will be maintained in the Troy field office for the duration of the TAPE project so that information is available if questions arise. The original forms will be stored in the Tetra Tech office in Helena, Montana, for the duration of the sampling, inspection, and reporting phases of the TAPE project. The original forms will be transferred to DEQ at the end of the TAPE project. Copies of the field forms and field logbook will be available on request at any time during the TAPE project to DEQ, EPA, or to the Troy property owners.

After the field forms have been received from the TAPE field teams, the Tetra Tech Field Data Coordinator will check all paperwork and corresponding location, building, and sample ID numbers for accuracy. The Tetra Tech Field Data Coordinator will then transfer the hard copies of the field forms and the associated dust, building material, and soil samples collected for the Troy properties to the CDM Troy Sample Coordinator. The CDM Troy Sample Coordinator will manually enter the information into the eLastic application for ultimate transfer to the Libby V2 database, pursuant to the eLastic data entry SOP (Appendix B). The CDM Troy Sample Coordinator will conduct a 100 percent data check to ensure that all information has been entered correctly. When the data check is complete, the CDM Troy Sample Coordinator will export the data to the Libby V2 database, via Volpe.

Until samples have been transferred to the CDM Troy Sample Coordinator, all TAPE samples will be held by Tetra Tech. Samples may be stored in locked vehicles or in a secured (locked) area of the Troy Tetra Tech field office. All TAPE samples collected from the Troy properties, including QC samples, will be transferred to the CDM Troy Sample Coordinator at least on a weekly basis. The CDM Troy Sample Coordinator will provide Tetra Tech with a copy of a chain of custody, pursuant to the electronic chain-of-custody SOP (Appendix B). The CDM Troy Sample Coordinator will then transfer the samples to the laboratory for preparation and analysis.

Digital photographs will be downloaded daily to a computer at the Tetra Tech Troy field office. Photographs will be downloaded and labeled using a standard labeling procedure that is based on property and building ID numbers. Individual photographs will not be routinely printed from the Troy field office.

6.0 DATA MANAGEMENT

Data management during the inspection and sampling will be under the supervision of the TAPE Field Data Coordinator in the Troy field office. At the conclusion of inspection and sampling, that responsibility will pass to the TAPE project manager.

6.1 DATA REQUISITION

The laboratory will report all analytical data to Volpe and Volpe will oversee integration of that data into the Libby V2 database. Tetra Tech and DEQ will obtain sampling data from the Libby V2 database by requesting that data from Volpe (through EPA) on a standard information request form. Tetra Tech will request the following information from the Libby V2 database for each sample, including QC samples, collected during the TAPE project:

- Sample location
- Sample name
- Sample date
- Sample results
- Identification numbers, dates, and results for laboratory quality control samples

Volpe will provide this information (through EPA) in the standard Libby V2 data report format. All other information necessary for reporting purposes will be obtained from Tetra Tech internal files (copies of IFFs, FSDSs, property sketches, and logbooks).

6.2 DATA REPORTING

Data from the Libby V2 database will be obtained through a geographic information system interface software (ArcView). This interface will provide maps showing all TAPE sample locations. Dust and soil sampling results will be provided from the Libby V2 database in tabulated form, as Microsoft Access files. Tetra Tech will prepare a TAPE project report that describes the activities conducted, the results of the property inspections, and the results of the sampling, evaluates data quality, and recommends follow-up actions. The TAPE project report will include maps for each property where asbestos in soil or in dust exceeded screening levels. TAPE project maps will show sample locations and results for the property and delineate the areal extent of asbestos.

7.0 QA/QC PROCEDURES

The TAPE quality objectives, QC checks and samples, and audits completed for the TAPE project are described in the sections below. Field quality control procedures are described in Section 5.0 above.

7.1 QA/QC OBJECTIVES

The quality objectives of the TAPE project are to obtain 100 percent usable and accurate data. These data will be achieved through inspection and sampling using standardized field forms and procedures, auditing field operations, observing chain of custody procedures, and analyzing field quality control samples and laboratory quality control samples. The DQOs are further discussed in Section 3.0 of this Work Plan.

7.2 INTERNAL QC CHECKS

When laboratory analytical data are received, Volpe will conduct a thorough quality review of that data. Volpe will review data from both laboratory QC samples described below and field QC samples described in Section 5.2. Standard protocols exist for validation of soil samples analyzed by PLM for asbestos and will be followed. Standard protocols do not exist for validation of dust samples for asbestos; however, EPA and their contractors will follow the QC review procedures for dust data established at the Libby Asbestos Superfund Site. EPA and their contractors will prepare validation and review packages for all TAPE data and will transmit the reports to Tetra Tech to be included in the TAPE project report.

Dust and soil samples will be analyzed by one of the contract laboratories following Libby Asbestos Superfund Site protocols, including EPA's most recent protocols relating to QA/QC for the Libby Asbestos Superfund Site. As such, the QA/QC protocols followed by the laboratories are not within Tetra Tech's immediate control.

Laboratory QA/QC samples and standard protocols that the contract laboratory will perform for routine analysis will include appropriate laboratory procedures for the analyses of the following sample types:

- Preparation Duplicate Samples
- Preparation Laboratory Equipment Blanks (grinding and other equipment)
- Method Blank Samples
- Matrix Spike/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Duplicates

- Standard Reference Material
- Surrogates

Volpe will enter data into the Libby V2 project database with a 100 percent QC of the data.

7.3 AUDITS, CORRECTIVE ACTIONS, AND QA REPORTS

Field audits will be an integral part of Tetra Tech's field operations for the duration of the TAPE project. Field audits and corrective actions will be the responsibility of the Tetra Tech QA/QC manager. (See Section 2.0 and Table 2-1 for designated key project personnel.) The TAPE project report will include a discussion of data quality that will include a summary of field audit results. Copies of field audit forms will be provided as an appendix to the TAPE project report.

7.3.1 Field Inspections and Sampling Procedures Audits

The Tetra Tech QA/QC manager will be responsible for audits of TAPE field inspections and sampling procedures. Audits will be conducted daily for the first 5 days of inspection and sampling and at least biweekly for the duration of the TAPE. Audits will consist of the QA/QC manager or his designee attending a Troy property inspection and sampling event and observing the TAPE field team's activities. The field team will not be notified of the audit. The auditor will compare the field team's activities with the protocols provided in this Work Plan and the attached SOPs and evaluate compliance with the protocols using the audit form provided in Appendix E. After the audit, the auditor will provide the completed audit form to the DEQ and Tetra Tech project managers.

7.3.2 Corrective Action Procedures

The QA/QC auditor may use his or her discretion to provide immediate verbal feedback to the TAPE field team if necessary to ensure that deficiencies are fixed as quickly as possible. The Tetra Tech field team leader and QA/QC manager will review the report with the TAPE field team within 48 hours of the audit to correct any deviations or deficiencies. If any deviations or deficiencies were noted, the field team will be audited again within 1 week of the original audit to ensure that any deficiencies have been fixed.

If gross deficiencies are noted, the Tetra Tech QA/QC manager will determine whether re-inspection or re-sampling of any Troy properties is required. Re-inspection or re-sampling will be required only if the TAPE field team failed to correctly identify VCI during inspection, collected samples incorrectly, or collected a grossly inadequate number of samples.

7.3.3 Laboratory Audits

The EPA contract laboratories used to analyze the Troy project samples will be required to provide proof of current certifications. Examples of certifications include the following: American Industrial Hygiene Association and the National Voluntary Laboratory Accreditation Program. The verification of laboratory certifications and QC controls will be under the jurisdiction of Volpe or EPA. These agencies are responsible for conducting the laboratory audits if required.

REFERENCES

American Society for Testing and Materials (ASTM). 1995. Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Building Number Concentrations. Designation D5755-95. October.

Camp Dresser & McKee (CDM). 2002. Final Sampling and Analysis Plan, Contaminant Screening Study, Libby Asbestos Site. April.

CDM. 2003a. Final Sampling and Analysis Plan, Remedial Investigation, Contaminant Screening Study, Revision 1. April

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Montana Department of Public Health & Human Services (DPHHS). 2005. Mesothelioma in Montana. September.

National Cancer Institute. 2005. Malignant Mesothelioma: Treatment, Health Professional Version. On-line address: http://www.cancer.gov/cancertopics/pdq/treatment/malignantmesothelioma/HealthProfessional.

U.S. Environmental Protection Agency (EPA). 2000a. "Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/ G-4HW)." Office of Environmental Information. Washington, D.C. EPA/600/R-00/007. January.

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EPA. 2000c. Sampling and Quality Assurance Project Plan for Libby, Montana, Environmental Monitoring for Asbestos. Revision 1. Region 8. January

EPA. 2003a. Final Sampling and Analysis Plan for Indoor Dust, Libby Asbestos Site, August.

EPA. 2003b. Libby Asbestos Site Residential/Commercial Cleanup Action Level and Clearance Criteria, Technical Memorandum. Draft Final. Prepared by US EPA with Technical Assistance from: Syracuse Research Corporation. December 15.

EPA. 2005. Region 8 Background Factsheet, Libby Asbestos. Last updated on Tuesday, July 5, 2005. URL: http://www.epa.gov/region8/superfund/libby/lbybkgd.html

EPA. 2005. Supplemental Remedial Investigation Quality Assurance Project Plan for Libby, Montana. Region 8. June.

U.S. Geological Survey (USGS). 2005. "Draft Denver Microbeam Laboratory Administrative Report No. 220805" Prepared for U.S. EPA by Gregory Meeker. August 22.

APPENDIX A

SITE-SPECIFIC HEALTH AND SAFETY PLAN
TROY ASBESTOS PROPERTY EVALUATION

APPENDIX B

STANDARD OPERATING PROCEDURES (SOPs)
TROY ASBESTOS PROPERTY EVALUATION

Tetra Tech - Troy

- Tetra Tech TAPE FSDS and IFF Completion Guidance, Version 01
- Tetra Tech TAPE Soil Sampling Guidance, Version 01

CDM/EPA – Libby

- CDM-Libby-05 Site-Specific Standard Operating Procedure for Soil Sample Collection
- CDM-Libby-07 CSF eLASTIC Module

American Society for Testing and Materials (ASTM)

- ASTM D5755-95

Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Building Number Concentrations

- ASTM E2356-04

Standard Practice for Comprehensive Building Asbestos Surveys

APPENDIX C

EQUIPMENT/SUPPLIES LIST
TROY ASBESTOS PROPERTY EVALUATION

APPENDIX D

SAMPLE COVER LETTER, ACCESS AGREEMENT, AND SAMPLE RECEIPT
TROY ASBESTOS PROPERTY EVALUATION

APPENDIX E

FIELD FORMS
TROY ASBESTOS PROPERTY EVALUATION

Health and Safety Plan

for

Troy Asbestos Property Evaluation (TAPE)

HEALTH AND SAFETY PLAN

Troy Asbestos Property Evaluation

Contract No.	:	DEQ 402014-TO41
	:	
Date Prepared	:	12/30/05
Prepared by	:	Tetra Tech EM Inc. (Tetra Tech)
Tech Project Manager	:	J. Edward Surbrugg, Ph.D.
Telephone No.	:	(406) 442-5588

REVIEWS AND APPROVALS

CLIENT NAME:
CONTRACT NO.:

We the undersigned have read and approve of the health and safety guidelines presented in this health and safety plan for on-site work activities for the Troy Asbestos Property Evaluation project.

Name	Signature	Date
Glynis Foulk Tetra Tech EM Inc. (Tetra Tech) Health and Safety Representative (916) 853-4561		
J. Edward Surbrugg, Ph.D. Tetra Tech Project Manager	__________________________	_______________

This certifies that Tetra Tech has assessed the type, risk level, and severity of hazards for the project and has selected appropriate personal protective equipment for site personnel in accordance with Occupational Safety and Health Administration Title 29 of the *Code of Federal Regulations*, Part 1910.132.

Certified by

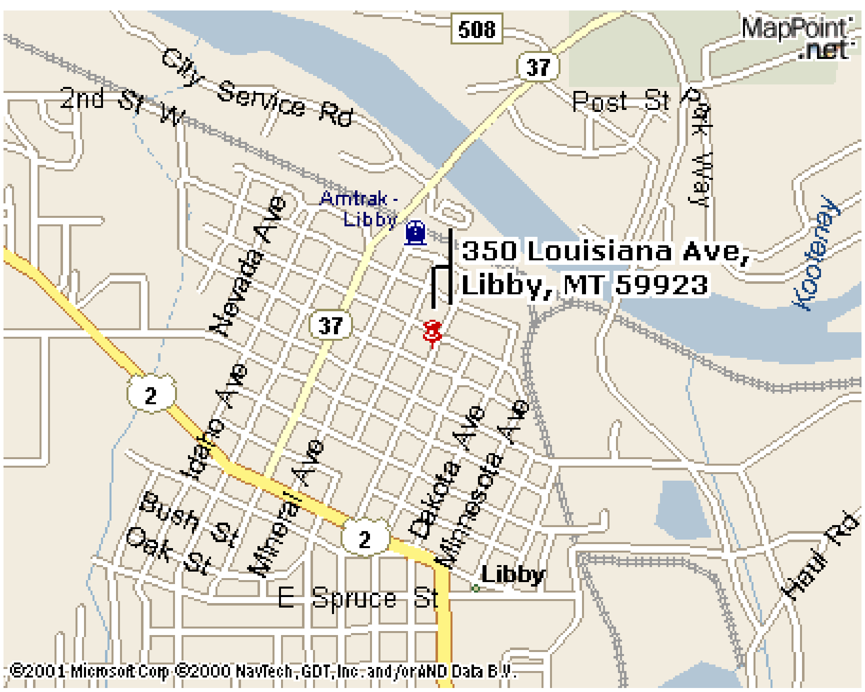
Glynis Foulk Tetra Tech Technical Reviewer	__________________________	_______________

EMERGENCY INFORMATION
EMERGENCY CONTACTS AND ROUTE TO HOSPITAL

Emergency Contact		**Telephone No.**
U.S. Coast Guard National Response Center		(800) 424-8802
Montana Department of Emergency Services		(406) 431-0411
InfoTrac Chemical Monitoring System		(800) 535-5053
Fire Department		911
Police Department		911
Tetra Tech EM Inc. Personnel:		
Human Resource Development: Amy Clark		(626) 351-4664
Health and Safety Representative: Glynis Foulk		(678) 775-3094
Office Health and Safety Coordinator: Sandra Hertweck		(406) 442-5588, ext. 221
Project Manager: J. Edward Surbrugg		(406) 442-5588, ext. 230
Site Safety Coordinator: Mark Stockwell		(208) 263-4524
Client Contact: Catherine LeCours		(406) 841-5040
Client Title: Montana DEQ Project Officer		
Medical Emergency		
Hospital Name:		St. John's Lutheran Hospital
Hospital Address:		350 Louisiana Avenue Libby, MT 59923
Hospital Telephone No.:	General – 406-293-0100	Emergency – 911
Ambulance Telephone No.:		911
Route to Hospital: (see next page, hospital route map) 1. Routes will differ from each sample site.		

Note: This sheet must be posted on site.

EMERGENCY INFORMATION
HOSPITAL ROUTE MAP



Note: This sheet must be posted on site.

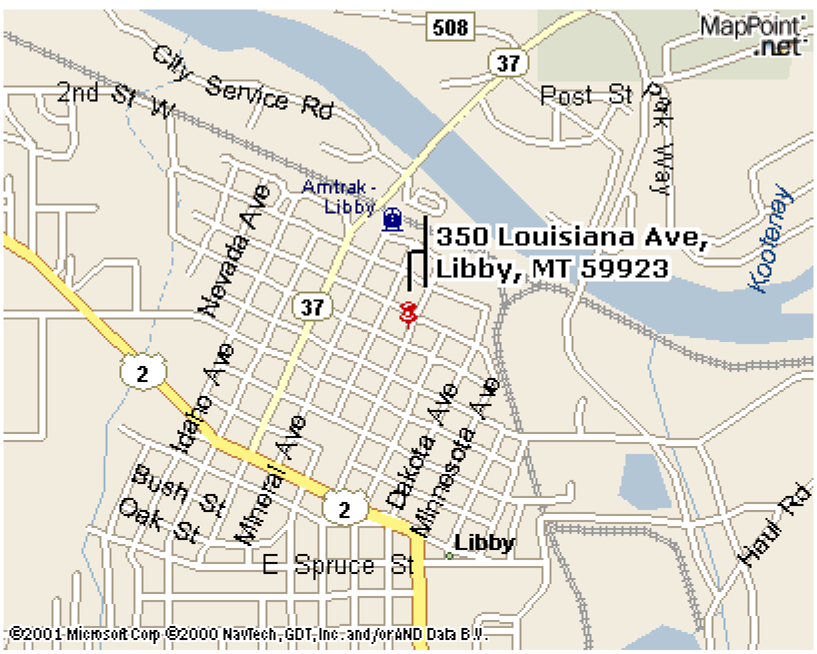
EMERGENCY INFORMATION

EMERGENCY CONTACTS AND ROUTE TO HOSPITAL

Medical Emergency (secondary – use for major emergency only)	
Hospital Name:	St. John's Lutheran Hospital
Hospital Address:	350 Louisiana Avenue, Libby, MT 59923
Hospital Telephone No.:	Emergency – 911 or General – 406-293-0100
Ambulance Telephone No.:	911
Route to Hospital: (see next page hospital route map) 1. Routes will differ from each sample site.	

EMERGENCY INFORMATION

HOSPITAL ROUTE MAP



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1.0 INTRODUCTION

This document addresses items specified under Occupational Safety and Health Administration (OSHA) Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120 (b), “Final Rule.” This health and safety plan (HASP) will be available to all on-site personnel who may be exposed to hazardous on-site conditions, including Tetra Tech EM Inc. (Tetra Tech) and subcontractor personnel, and all site visitors and regulatory agency representatives. The site-specific health and safety provisions in this document have been developed for use during the Troy Asbestos Property Evaluation (TAPE) inspection and sampling

This HASP defines requirements and designates protocols to be followed during the TAPE inspection and sampling. All personnel on site, including Tetra Tech and subcontractor employees and site visitors, must be informed of site emergency response procedures and any potential health or safety hazards associated with on-site activities. This HASP summarizes potential hazards and defines protective measures planned for activities at the site.

This plan must be reviewed and approved by the Tetra Tech health and safety representative (HSR) or a designee and the Tetra Tech project manager (see the Reviews and Approvals form after the contents in this document). All personnel must sign the Compliance Agreement form in Appendix A before they enter the site. Protocols established in this HASP are based on site conditions and health and safety hazards known or anticipated to be present and on available site data. This plan is intended solely for use during proposed activities described in the corresponding site-specific work plan. Specifications are subject to review and revision based on actual conditions encountered in the field during site activities. The Tetra Tech project manager and the Tetra Tech HSR must approve significant revisions to this plan. Tetra Tech employees must also follow safety requirements taught during safety training and described in the Tetra Tech, Inc., “Health and Safety Manual” (1999).

2.0 HEALTH AND SAFETY PLAN ENFORCEMENT AND PERSONNEL

This section describes responsibilities of project personnel, summarizes requirements for subcontractors and visitors who wish to enter the site during the survey and sampling, and discusses HASP enforcement.

2.1 PROJECT PERSONNEL

The following personnel and organizations are associated with planned activities at the site. The organizational structure will be reviewed and updated as necessary during the course of the project.

Name/Title	Responsibility	Telephone No.
Client Representative:		
Ms. Catherine LeCours	Montana Department of Environmental Quality (DEQ) Representative	(406) 841-5040
Tetra Tech Personnel:		
J. Edward Surbrugg	TAPE Project Manager	(406) 442-5588 x 230
Brian Antonioli	Contract Manager	(406) 442-5588 x 235
Mark Stockwell	Site Safety Coordinator (SSC)	(208) 263-4524
Mark Stockwell	Field Team Leader	(208) 263-4524

The Tetra Tech project manager, contract manager, SSC, and field team leader will be responsible for implementation and enforcement of the provisions of this HASP, including completion of all applicable forms provided as appendices to this health and safety plan. Their duties and the expectations for Tetra Tech employees are described in the following sections.

2.1.1 Project Manager and Field Manager

The Tetra Tech project manager has ultimate responsibility for implementing the requirements set forth in this HASP. Some of this responsibility may be achieved through delegation to site-dedicated personnel who report directly to the project manager. The project manager shall regularly confer with site personnel on compliance with safety and health requirements.

The Tetra Tech field team leader will oversee and direct field activities and has day-to-day responsibility for implementing the HASP. The field manager will report directly to the project manager any health and safety-related issues.

2.1.2 Site Safety Coordinator

The Tetra Tech SSC will be appointed by the project manager and will be responsible for field implementation of tasks and procedures contained in this HASP, including air monitoring, establishing a decontamination protocol, and ensuring that all personnel working on site have signed the Daily Tailgate Safety Meeting form (Form HST-2) and the Compliance Agreement (Form HSP-4) (see Appendix A). The SSC will have advanced field work experience and be familiar with health and safety requirements specific to the project. The SSC will also maintain the Daily Site Log (Form SSC-1 in Appendix A).

2.1.3 Health and Safety Representative

The Tetra Tech HSR is responsible for administration of the company health and safety program. The HSR will act in an advisory capacity to project managers and site personnel for project-specific health and safety issues.

2.1.4 Tetra Tech Employees

Tetra Tech employees are expected to fully participate in implementing the site HASP by obtaining necessary training, attending site safety meetings, always wearing designated personal protective equipment (PPE), complying with site safety and health rules, and advising the Tetra Tech SSC of health and safety concerns at the site.

2.2 SUBCONTRACTORS

Subcontractors will follow and adhere to the same guidelines stated in Section 2.1.4

2.3 VISITORS

All site visitors will be required to read the HASP and sign the Compliance Agreement form (see Appendix A). Visitors will be expected to comply with relevant OSHA requirements. Visitors will also be expected to provide their own PPE as required by the HASP. Visitors who have not met OSHA requirements for training, medical surveillance, and PPE are not permitted to enter areas where exposure to hazardous materials is possible.

2.4 HEALTH AND SAFETY PLAN ENFORCEMENT

This HASP applies to all site activities and all personnel working on the TAPE project. HASP enforcement shall be rigorous. Violators of the HASP will be verbally notified on first violation, and the Tetra Tech SSC will note the violation in a field logbook. On a second violation, the violator will be notified in writing, and the Tetra Tech project manager and the violator's supervisor will be notified. A third violation will result in a written notification and the violator's eviction from the site. The written notification will be sent to human resources development and the HSR.

Personnel will be encouraged to report to the SSC any conditions or practices that they consider detrimental to their health or safety or that they believe violate applicable health and safety standards. These reports may be made orally or in writing. Personnel who believe that an imminent danger threatens human health or the environment are obligated to remove themselves from the area or the hazardous condition and warn all other personnel of the source of the danger. The hazardous condition or matter will be brought to the immediate attention of the SSC for resolution.

At least one copy of this HASP will be available to all site personnel at all times. The SCC will discuss minor changes in HASP procedures at the beginning of each workday at the daily tailgate safety meeting. Significant plan revisions must be discussed with the HSR and project manager.

3.0 SITE BACKGROUND

The TAPE inspection and sampling project will include collecting samples of dust and soil from private and public property to evaluate the magnitude and extent of asbestos contamination and develop viable remedial alternatives. The following sections describe the TAPE site, its history, and activities planned for this project. The location of Troy, Montana, can be found in Figure 1.

FIGURE 1 – SITE LOCATION

3.1 SITE DESCRIPTION

Troy, Montana, is located 18 miles from Libby, Montana. Through 1990, a vermiculite mine and associated processing operations in Libby produced a large amount of the world's supply of vermiculite. The vermiculite deposit is contaminated with a form of amphibole asbestos (Libby amphibole). Asbestos is a known carcinogen and is associated with a multitude of respiratory health effects, including asbestosis, lung cancer, and mesothelioma. For decades, contaminated vermiculite and waste materials were ubiquitous in the community while the mine operated and after its closure. Many of the mine workers lived in Troy and commuted to the mine to work because Troy is close to Libby. Workers were exposed to contaminated materials at the mine and processing facilities; they transported contaminated dust to their homes on clothes and equipment; and vermiculite and contaminated waste rock in varying forms was used in soils (as fill or an amendment), construction materials, and for insulation all around the town.

In 1999, U.S. Environmental Protection Agency (EPA) Region 8 dispatched an emergency response team to investigate in response to media reports that described a high rate of asbestos-related deaths in Libby. Originally believed to be a problem limited to the mine workers, the scope has increased. Subsequent environmental investigations have found many areas in Libby with LA contamination. EPA began Superfund emergency response removal actions in Libby in 2000 that are ongoing through 2007. Properties in Troy are being investigated to evaluate whether LA-contaminated vermiculite has been transported to these sites and at concentrations that would pose health risks to the occupants.

3.2 PLANNED ACTIVITIES

Activities to be performed during the TAPE include the following…

Indoor Inspections: The two-person sampling team will visually inspect each structure for the presence of vermiculite-containing insulation (VCI).

Indoor dust sampling: Dust samples will be collected using microvac sampling techniques in all primary and secondary structures.

Outdoor Inspection: All areas of a property that are not covered with structures or special use areas will be inspected for vermiculite product in soil and surfacing materials.

Outdoor Soil Sampling: After conducting the visual inspection of the property, the sampling team will collect soil samples.

These tasks are described in detailed in Section 4 of the TAPE work plan.

4.0 EVALUATION OF SITE-SPECIFIC HAZARDS

Field activities and physical features of the site may expose field personnel to a variety of hazards. This section provides information on potential hazards related to site activities and the nature of effects from hazardous materials.

4.1 CHEMICAL HAZARDS

Tremolite-actinolite asbestos is the only potentially hazardous substance anticipated to be encountered during site activities. Potential routes of exposure, exposure limits, and the toxic characteristics of asbestos are listed in Table 4-1. The primary route of exposure is inhalation; however, secondary potential routes of exposure include dermal (skin) contact and ingestion. Asbestos may also contaminate equipment, vehicles, instruments, and personnel. The overall health threat from exposure to asbestos is uncertain because (1) actual concentrations that personnel could be exposed to cannot be predicted, (2) the actual duration of exposure is unknown, and (3) the effects of low-level exposure to a mixture of chemicals or asbestos cannot be predicted. However, Tetra Tech believes that the potential for high-level exposure is limited.

Specific information on potential chemical hazards at the site is provided in Table 4-1. Table 4-2 provides a task hazard analysis of the activities planned and listed in Section 3.2.

Tetra Tech will not bring any potentially hazardous materials to the site during the field activities. Because of the nature of asbestos sampling, all PPE and monitoring equipment can be decontaminated using soap and water. Air monitoring equipment to be used during this project will be calibrated without the use of hazardous materials.

TABLE 4-1

POTENTIAL CHEMICAL HAZARDS
TAPE INSPECTION AND SAMPLING PROJECT

Chemical	Exposure Limits and IDLH Level	Exposure Routes	Toxic Characteristics
Asbestos	OSHA PEL: 0.1 fiber/cm^3 (8 hour TWA) ACGIH TLV: 0.1 fiber/cm^3 IDLH: Not Established	Inhalation (primary), ingestion, skin or eye contact	Asbestosis, lung cancer, mesothelioma

Notes:

ACGIH American Conference of Governmental Industrial Hygienists
IDLH Immediately dangerous to life or health
cm^3 Cubic centimeter
OSHA Occupational Safety and Health Administration
PEL Permissible exposure limit
ppm Part per million
TLV Threshold limit value
TWA Time weighted average

Sources: ACGIH. "Threshold Limit Values and Biological Exposure Indices for 1998." Latest edition.

National Institute for Occupational Safety and Health. 1997. "Pocket Guide to Chemical Hazards." U.S. Department of Health and Human Services. U.S. Government Printing Office. Washington, DC. June.

TABLE 4-2

TASK HAZARD ANALYSIS
TAPE Inspection and Sampling Project

Task	Potential Hazard	Controls	Initial Level of Protection	Upgraded Level of Protection
Task 1 – Interior Attic Evaluations and dust sampling	Potential asbestos exposure. Physical hazards include confined space entry; and slip, trip, fall, and overhead hazards. Risks associated with ladder use. Risks associated with falls between roof trusses.	Use of buddy system at all times, use of flashlights when necessary, hazard awareness. Sampling will be conducted to limit the potential for exposure. Sample areas will be wetted before samples are collected, when necessary. Performance of personal air monitoring at selected locations. Follow Safe Work Practices (SWP).	Level C protection when accessing all attic spaces	Potential for upgrade to level C protection may be necessary using P-100 cartridges. Full or ½ face respirator can be used. Decision to upgrade to be made by the SSC/field manager based on site conditions, monitoring results, and presence of friable asbestos.
Task 2 – Exterior yard and open area inspections and soil sampling	Potential asbestos exposure. Physical hazards include slip, trip, and falls.	Use of buddy system and hazard awareness. Follow SWPs.	Level D protection	Decision to upgrade to be made by the SSC/Field Manager based on site conditions, monitoring results, and presence of friable asbestos.

The following steps will be taken o reduce the potential for inhaling asbestos:

- Personnel will avoid sampling methods and procedures that would render nonfriable asbestos-containing material (ACM) friable.
- The level of PPE shall be upgraded from level D to level C at any time that sampling conditions warrant, as determined by the SSC or field manager.

4.2 PHYSICAL AND BIOLOGICAL HAZARDS

Physical and biological hazards associated with site activities present a potential threat to on-site personnel. Dangers are posed by slippery surfaces, unseen obstacles, poor illumination, use of ladders, and low overhead clearance, as well as insects, Hantavirus, and hostile animals.

Injuries resulting from physical and biological hazards can be avoided by using safe work practices (SWP). To maintain a safe workplace, the SSC will conduct and document regular safety inspections and will make sure that all Tetra Tech workers and visitors are informed of any potential physical and biological hazards related to the site. Physical and biological hazards that have been identified at this site include the following:

- Spiders, including brown recluse and black widow
- Potential disease agents from animal/bird feces, including Hantavirus
- Hostile domestic or stray animals
- Use of ladders and other equipment to access attics and areas for sample collection
- Trips, slips, falls in yards and open areas
- Heat stress
- Cold stress
- Fall hazard (from ladders and through roof trusses in attics)
- Potential confined space entry – no permits are anticipated to be necessary for sampling, however

5.0 TRAINING REQUIREMENTS

All on-site personnel who may be exposed to hazardous conditions, including Tetra Tech and subcontractor personnel and site visitors who will participate in on-site activities, will be required to meet training requirements outlined in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response." All personnel and visitors entering the site will be required to review this HASP and sign the Compliance Agreement form (HSP-4), and site workers will be required to sign the Daily Tailgate Safety Meeting form (HST-2) (see Appendix A).

Personnel collecting asbestos samples will, at a minimum, be licensed asbestos inspectors in the State of Montana and be 40-hour HAZWOPER trained.

Before on-site activities begin, the Tetra Tech SSC will present a briefing for all personnel who will participate in on-site activities. The following topics will be addressed during the prework briefing:

- Names of the SSC and the designated alternate
- Site history
- Tasks
- Hazardous chemicals that may be encountered on site
- Physical hazards that may be encountered on site
- PPE, including type or types of respiratory protection to be used for work tasks
- Training requirements
- Action levels and situations requiring upgrade or downgrade of level of protection
- Site control measures, including site communications, and SWPs
- Decontamination procedures
- Emergency communication signals and codes
- Personnel exposure and accident emergency procedures (in case of falls, exposure to hazardous substances, and other hazardous situations)
- Emergency telephone numbers
- Emergency routes

Any other health and safety-related issues that may arise before on-site activities begin will also be discussed during the pre-work briefing.

Issues that arise during on-site activities will be addressed during tailgate safety meetings to be held daily before the workday or shift begins that will be documented in the Daily Tailgate Safety Meeting form (Form HST-2 in Appendix A). Any changes in procedures or site-specific health and safety-related matters will be addressed during these meetings.

6.0 PERSONAL PROTECTION REQUIREMENTS

The levels of PPE to be used for work tasks during the TAPE will be selected based on known or anticipated physical hazards; types and concentrations of contaminants that may be encountered on site; and contaminant properties, toxicity, exposure routes, and matrices. The following sections describe protective equipment and clothing; reassessment of protection levels; limitations of protective clothing; and respirator selection, use, and maintenance.

6.1 PROTECTIVE EQUIPMENT AND CLOTHING

Personnel will wear protective equipment when (1) site activities involve known or suspected contamination; (2) site activities may generate asbestos particulates; or (3) direct contact with hazardous materials may occur. The anticipated levels of protection selected for use by field personnel during site activities are listed in Table 4-2, Task Hazard Analysis. Based on the anticipated hazard level, personnel will initially perform field tasks in level D protection.

If site conditions or the results of air monitoring during on-site activities warrant a higher level of protection, all field personnel will immediately notify the Tetra Tech SSC. Based on the initial site walk-through and conditions encountered during sample collection, a PPE upgrade to level C protection is anticipated in some of the areas to be sampled. This PPE upgrade will typically occur whenever vermiculite-containing insulation (VCI) or Libby vermiculite (LV) is encountered. Equipment and clothing required for level D and level C protection are described below.

- Level D
  - Coveralls or work clothes, if applicable
  - Chemical-resistant clothing (such as Tyvek or Saranex coveralls)
  - Disposable gloves (latex or vinyl), if applicable
  - Work gloves, if applicable

- Boots with steel-toe protection and steel shanks
- Disposable boot covers or chemical-resistant outer boots, if applicable
- Safety glasses or goggles
- Hard hat (face shield optional)
- Hearing protection (for areas with a noise level that exceeds 85 decibels on the A-weighted scale)

- Level C
  - Coveralls or work clothes, if applicable
  - Chemical-resistant clothing (such as Tyvek or Saranex coveralls)
  - Outer gloves (neoprene, nitrile, or other), if applicable
  - Disposable inner gloves (latex or vinyl)
  - Boots with steel-toe protection and steel shanks
  - Disposable boot covers or chemical-resistant outer boots
  - Full- or half-face, air-purifying respirator with National Institute for Occupational Safety and Health (NIOSH)-approved cartridges to protect against organic vapors, dust, fumes, and mists. (Cartridges used for gas and vapors must be replaced in accordance with the change-out schedule described in the Respiratory Hazard Assessment form [Form RP-2] in Appendix C.) P-100 cartridges will be used.
  - Safety glasses or goggles (with a half-face respirator only)
  - Hard hat (face shield optional)
  - Hearing protection (for areas with a noise level that exceeds 85 decibels on the A-weighted scale)

6.2 REASSESSMENT OF PROTECTION LEVELS

PPE levels will be upgraded or downgraded based on a change in site conditions or findings of the investigation. Hazards will be reassessed when a significant change in site conditions occurs. Some indicators of the need for reassessment are as follows:

- Commencement of a new phase of work, such as the start of a significantly different sampling activity or work that begins on a different portion of the site
- Potential for release of amphibole asbestos
- A change in tasks during a work phase
- A change of season or weather
- Temperature extremes or individual medical considerations that would limit the effectiveness of PPE

- Discovery of contaminants other than were previously identified
- A change in ambient levels of airborne contaminants (see the action levels listed in Table 8-1)
- A change in work scope that affects the degree of contact with contaminated media

6.3 LIMITATIONS OF PROTECTIVE CLOTHING

PPE clothing ensembles designated for use during site activities have been selected to protect against contaminants at known or anticipated on-site concentrations and physical states. However, no protective garment, glove, or boot is entirely chemical-resistant, nor does any protective clothing protect against all types of chemicals. Permeation of a chemical through PPE depends on the contaminant concentration, environmental conditions, the physical condition of the protective garment, and the resistance of the garment to the specific contaminant. Chemical permeation may continue even after the source of contamination has been removed from the garment.

All site personnel will use the following procedures to obtain optimum performance from PPE.

- When chemical-protective coveralls become contaminated, don a new, clean garment after each rest break or at the beginning of each shift.
- Inspect all clothing, gloves, and boots both before and during use for the following:
  - Imperfect seams
  - Nonuniform coatings
  - Tears
  - Poorly functioning closures
- Inspect reusable garments, boots, and gloves both before and during use for visible signs of chemical permeation, such as the following:
  - Swelling
  - Discoloration
  - Stiffness
  - Brittleness
  - Cracks
  - Punctures
  - Abrasions

Reusable gloves, boots, or coveralls that exhibit any of the characteristics listed above must be discarded. Reusable PPE will be decontaminated in accordance with procedures described in Section 10.0 and will be neatly stored in the support zone away from work zones.

6.4 RESPIRATOR SELECTION, USE, AND MAINTENANCE

Tetra Tech personnel will be informed of the proper use, maintenance, and limitations of respirators during annual health and safety refresher training and the prework briefing. Any on-site personnel who will use a tight-fitting respirator must pass a qualitative fit test for the respirator that follows the fit testing protocol provided in Appendix A of the OSHA respirator standard (29 CFR 1910.134). Fit testing must be repeated annually or when a new type of respirator is used.

Respirators are selected based on the assessment of the nature and extent of hazardous atmospheres anticipated during field activities. This assessment includes a reasonable estimate of employee exposure to respiratory hazards and identification of each contaminant's anticipated chemical form and physical state.

A respiratory hazard assessment has been conducted for each task that will require use of a respirator during the TAPE project. The results of this assessment are documented in the Respiratory Hazard Assessment form (Form RP-2), which has been approved by the HSR. The completed Form RP-2 is included in Appendix C and defines respiratory protection requirements for the project. Amendments to this HASP and to Form RP-2 will be discussed during daily tailgate safety meetings.

When the atmospheric contaminant is identified and its concentration is known or can be reasonably estimated, respiratory protection options include the following:

- An atmosphere-supplying respirator (air-line or SCBA)
- An air-purifying respirator equipped with a NIOSH-certified, end-of-service-life indicator (ESLI) for the identified contaminant. If no ESLI is available, a change-out schedule for cartridges must be developed based on objective data or information. The HSR will evaluate respirator cartridge selection and change-out schedules during the respiratory hazard assessment. The Respiratory Hazard Assessment, Form RP-2, will describe the information and data used as the basis for the cartridge change-out schedule and the proposed change schedule.

For protection against particulate contaminants including friable asbestos, approved respirators can include the following:

- An atmosphere-supplying respirator

- A respirator equipped with a filter certified by NIOSH under 32 CFR Part 11 or 42 CFR Part 84 as a P100 filter (formerly known as a high-efficiency particulate air [HEPA] filter)

A full- or half-face, air-purifying respirator equipped with NIOSH-approved cartridges or filters will be selected to protect against particulates, vapors, gases, and aerosols for any tasks performed in level C PPE.

Air-purifying respirators will be used only in conjunction with breathing-space air monitoring, which must be conducted in adherence to the action levels outlined in Table 8-1. Air-purifying respirators will be used only when they can protect against the substances encountered on site.

Factors that would preclude use of level C and air-purifying respirators are as follows:

- Oxygen-deficient atmosphere (less than 19.5 percent oxygen)
- Concentrations of substances that may be immediately dangerous to life and health
- Confined or unventilated areas that may contain airborne contaminants not yet characterized
- Unknown contaminant concentrations or concentrations that may exceed the maximum use levels for designated cartridges documented in the selected cartridge manufacturer's instructions
- Unidentified contaminants
- High relative humidity (more than 85 percent, which reduces the sorbent life of the cartridges)
- Respirator cartridges with an undetermined service life

Use, cleaning, and maintenance of respirators are described in SWP 6-27, Respirator Cleaning Procedures, and SWP 6-28, Safe Work Practices for Use of Respirators. These SWPs are included in Appendix B.

7.0 MEDICAL SURVEILLANCE

The following sections describe Tetra Tech's medical surveillance program, including health monitoring requirements, site-specific medical monitoring, and medical support and follow-up requirements.

Procedures documented in these sections will be followed for all activities during the TAPE project. Additional requirements are defined in the Tetra Tech, Inc., “Health and Safety Manual.”

7.1 HEALTH MONITORING REQUIREMENTS

All Tetra Tech and subcontractor personnel involved in on-site activities for the TAPE project must participate in a health monitoring program as required by 29 CFR 1910.120(f). Tetra Tech has established a health monitoring program with WorkCare, Inc., of Orange, California. Under this program, Tetra Tech personnel receive baseline and annual or biennial physical examinations consisting of the following:

- Complete medical and work history
- Physical examination
- Vision screening
- Audiometric screening
- Pulmonary function test
- Resting electrocardiogram
- Chest x-ray (required once every 3 years)
- Blood chemistry, including hematology and serum
- Urinalysis
- For sampling asbestos licensed workers will meet the medical monitoring requirements of their licenses

Tetra Tech receives a copy of the examining physician’s written opinion for each employee after post-examination laboratory tests have been completed; the Tetra Tech employee also receives a copy of the written opinion. This opinion includes the following information (in accordance with 29 CFR 1910.120[f][7]):

- The results of the medical examination and tests
- The physician’s opinion as to whether the employee has any medical conditions that would place the employee at an increased risk of health impairment from work involving hazardous waste operations or during an emergency response

- The physician's recommended limitations, if any, on the employee's assigned work; special emphasis is placed on fitness for duty, including the ability to wear any required PPE under conditions expected on site (for example, temperature extremes)

- A statement that the employee has been informed by the physician of the medical examination results and of any medical conditions that require further examination or treatment

All subcontractors must have health monitoring programs conducted by their own clinics in compliance with 29 CFR 1910.120(f). Any visitors or observers at the site will be required to provide records in compliance with 29 CFR 1910.120(f) before they can enter the site.

7.2 MEDICAL SUPPORT AND FOLLOW-UP REQUIREMENTS

All employees are entitled to and encouraged to seek medical attention and physical testing as a follow-up to an injury that requires care beyond basic first aid or to possible exposure above established exposure limits. These injuries and exposures must be reported to the HSR. Depending on the type of injury or exposure, follow-up testing, if required, must occur within 24 to 48 hours of the incident. It will be the responsibility of the employer's medical consultant to advise the type of test required to accurately monitor for exposure effects. The Tetra Tech SSC must complete the Accident and Illness Investigation Report (Form AR-1 in Appendix A) in the event of an accident, illness, or injury. A copy of this form must be forwarded to the HSR for use in determining whether the incident should be recorded and to be included in Tetra Tech's medical surveillance records.

8.0 ENVIRONMENTAL MONITORING AND SAMPLING

Environmental monitoring or sampling will be conducted to assess personnel exposure levels as well as site or ambient conditions and to establish appropriate levels of PPE. The following sections discuss initial and background air monitoring, personal monitoring, ambient air monitoring, monitoring parameters and devices, use and maintenance of survey equipment, thermal stress monitoring, and noise monitoring. Site-specific air monitoring requirements and action levels are provided in Table 8-1.

8.1 INITIAL AND BACKGROUND AIR MONITORING

Initial air monitoring of a typical work area will be performed at the beginning of the field sampling project to document airborne fiber levels in attic spaces that contain VCI or LV. Initial exposure assessments will be required for personnel who participate in the TAPE project. Personal air monitoring will be required during the initial phase of the TAPE to document airborne exposures. The assessments must be used to document typical exposures during specific types of field activities to establish the PPE

TABLE 8-1

SITE-SPECIFIC AIR MONITORING REQUIREMENTS AND ACTION LEVELS

Contaminant or Hazard	Task	Monitoring Device	Action Level	Monitoring Frequency	Action[a]
Asbestos	Tasks 1 and 2	Gilair-5 Air Sampler (personal)	<one half of PEL or TLV	Select locations – presence of friable asbestos	Results will be received the day after sampling. Work practices will be changed accordingly.

Notes:

< Less than
PEL Permissible exposure limit
TLV Threshold limit value
[a] Refer to Table 4-2 for specific types of gloves, chemical resistant clothing, respirators, and cartridges

required. This exposure assessment will be conducted for each two-person field sampling team. The exposure levels must be documented before the levels of PPE required during the work can be downgraded. The assessments must also be conducted using personal air sampling whenever there is a change in working conditions.

8.2 PERSONAL MONITORING

The employees working closest to a source of contamination have the highest likelihood of exposure to airborne contaminant concentrations that may exceed established exposure limits. Therefore, the workers who are closest to a source of contaminant generation will be selectively monitored during site activities. Personal monitoring will be conducted in the breathing zone and, if a worker is wearing respiratory protective equipment, outside the face piece. The breathing zone air will be monitored at select locations, such as in the presence of friable asbestos.

Air monitoring will be performed to calculate the airborne fiber concentration to ensure that employee exposure remains below the prescribed permissible exposure limit (PEL) or excursion limit. The worker’s exposure will be measured by first collecting an air sample from within the breathing zone (within 12 inches from the nose) throughout an entire workshift. This measurement usually necessitates that workers wear the pump near the waist. The personal air monitoring will be evaluated based on the different work activities that are being conducted. A representative set of air samples will be collected during activities that represent typical field days during the TAPE.

The sampling pump flow rates will be between 0.5 liters/minute and 2.5 liters/minute when using a 25-millimeter cassette. Once this sample is analyzed, the results shall be used to calculate the average level of exposure during the complete workshift (the time weighted average, TWA). The TWA is calculated as follows:

$$TWA = \frac{C1\ T1 + C2\ T2 + C3\ T3}{T1 + T2 + T3}$$

T = sample times (duration of exposure in minutes or hours)
C = airborne asbestos fiber concentration (in fibers per cubic centimeter, f/cc)

The TWA results will then be used for comparison to the PEL and to evaluate compliance with permissible exposure limits as established by OSHA. They will also be used to dictate which type of respiratory protection is required to ensure that the PEL is not exceeded.

Personal air samples will also be collected and analyzed in the manner described above for comparison to the exposure limit. The samples will be collected for 30 minutes during operations.

8.3 MONITORING PARAMETERS AND DEVICES

The following sections below briefly describe the use and limitations of instruments used to monitor for asbestos, combustible atmospheres, percent oxygen, and particulates. Site-specific air monitoring requirements and action levels are listed in Table 8-1.

All monitors will be calibrated in accordance with manufacturer recommendations at the beginning of every workday, if possible. Calibration results along with air monitoring data will be recorded in the field logbook.

8.3.1 Asbestos

Air monitoring will be conducted selectively during sampling to provide information on exposure and identify the need for upgrades from level D PPE to level C PPE. In addition, air monitoring will be conducted to make certain that asbestos is not being released to the areas used by workers as a result of sampling.

Work during the TAPE will be initially conducted in level D PPE; however, level C PPE will be required whenever attic access is required or whenever VCI or LV is sampled. The action level for sampling activities is one-half the PEL (0.05 f/cc). Additionally, upgrade to level C PPE will also be based on the material sampled and at the discretion of the SSC. Personal air monitoring for particulates will be conducted and analyzed by a laboratory. Laboratory results will be received post exposure (less than 1 day) to assess sampling conditions and change PPE accordingly.

8.3.2 Particulates

Friable asbestos is anticipated to be encountered during sampling. Other particulates, such as mineral wood, fiberglass, and other insulating materials, may be encountered in attic areas but are not known.

Particulate air monitoring is the process of measuring the fiber content of a known volume of air collected during a specific period of time. The acceptable procedure for airborne asbestos measurement for personal exposure monitoring is phase contrast microscopy (PCM) using the OSHA reference method specified in Appendix A of 29 CFR 1926.1101. This NIOSH 7400 Method is also acceptable for measuring airborne fiber levels in area samples. The OSHA asbestos regulations, which contain the PEL, were written to regulate asbestos-related activities typically found within industrial or construction settings. OSHA assumes that, the majority of the airborne fibers in these settings will be asbestos. In line with this assumption, the OSHA PEL is based on total airborne fiber exposures and not specifically airborne asbestos fibers.

The acceptable procedure for airborne asbestos measurement by transmission electron microscopy (TEM) is the method EPA specified in 40 CFR 763, Appendix A to Subpart E, Interim Transmission Electron Microscopy Analytical Methods. TEM sampling provides greater analytical sensitivity and can differentiate between asbestos and non-asbestos fibers. TEM sampling will be limited during the TAPE. TEM samples will be collected only if PCM samples cannot be analyzed because of overloading from nuisance particulates, or when fibers must be differentiated.

8.4 USE AND MAINTENANCE OF SURVEY EQUIPMENT

All personnel using field survey equipment must have training in its operation, limitations, and maintenance. Maintenance and internal or electronic calibration will be performed in accordance with manufacturer recommendations by personnel who are familiar with the devices before they are used on site. Repairs, maintenance, and internal or electronic calibration of these devices will be recorded in an equipment maintenance logbook. Results of routine calibration will be recorded on daily air sampling data sheets.

8.5 THERMAL STRESS MONITORING

Heat stress and cold stress are common and serious threats at hazardous waste sites. SWPs 6-15 and 6-16 discuss heat and cold stress and include monitoring methods appropriate for the season and location of work (see Appendix B).

9.0 SITE CONTROL

Site control is an essential component in HASP implementation. The following sections discuss measures and procedures for site control, such as on-site communications, site control zones, site access control, site safety inspections, and SWPs.

9.1 ON-SITE COMMUNICATIONS

Successful communication between field teams and personnel is essential. The following communication systems will be available during site activities:

- Cellular telephones or two-way radios

The hand signals listed below will be used by site personnel in emergency situations or when verbal communication is difficult.

Signal	Definition
Hands clutching throat	Out of air or cannot breathe
Hands on top of head	Need assistance
Thumbs up	Okay, I am all right, or I understand
Thumbs down	No or negative
Arms waving upright	Send backup support
Gripping partner’s wrist	Exit area immediately

9.2 SITE CONTROL ZONES

The following site control zones will be established for each property and work task.

9.2.1 Zone 1: Exclusion Zone

An exclusion zone includes areas where contamination is either known or likely to be present or, because of work activity, has the potential to cause harm to personnel. Typically, these areas will be limited to attics and crawl spaces during the TAPE. The exclusion zone will be established before Tetra Tech employees access attic and crawl space areas to collect samples. Other building occupants and visitors will be restricted from entering the exclusion zone during sampling procedures. Work tasks that may require establishment of an exclusion zone include the following:

Task 1– Interior sampling of VCI and LV in attics and crawl spaces.

Exclusion zones will not be established during collection of dust samples within other interior areas of buildings or during collection of soil samples outside the buildings. However, building occupants should be restricted from the immediate area during these procedures.

9.2.2 Zone 2: Decontamination Zone

Decontamination zones will be established during the TAPE project, such as at the base of ladders used to access attic spaces or outside of crawl space entrances. These areas will be covered with two layers of polyethylene sheeting during sampling in the exclusion zones. Personal decontamination will entail removing of protective garments after field crews descend from attic areas or exit crawl spaces. Tetra Tech personnel will use disposable wet wipes to wash respirators and exposed areas such as faces and hands. Sampling equipment will be decontaminated at the sample locations. Decontamination procedures will consist of a water rinse or damp rag cleaning of equipment after each sample collected. The decontamination zone will contain facilities to decontaminate personnel and portable equipment. Equipment decontamination procedures are described in Section 10.0. All PPE and polyethylene sheeting will be place in disposal bags and sealed before Tetra Tech employees exit the decontamination zones. After personal and equipment decontamination are complete and polyethylene sheeting removed, decontamination areas will be cleaned of debris and residue using appropriate HEPA vacuuming or wet cleaning procedures. Visitors including building occupants will not be permitted to enter the decontamination zone without proper qualifications and Tetra Tech SSC authorization.

9.2.3 Zone 3: Support Zone

A support zone may consist of any uncontaminated and nonhazardous part of the site, such as areas adjacent to decontamination zones at the base of ladders used to access attic spaces or outside of crawl space entrances. Sampling procedures will immediately stop if visible suspect asbestos-contaminated debris is observed outside of the sampling or decontamination areas at any time during sampling after the exclusion zone has been established. Debris and residue will be cleaned up using appropriate HEPA vacuuming or wet cleaning procedures before work recommences. Site visitors who do not meet training, medical surveillance, and PPE requirements must stay outside of the support zone.

9.3 SITE ACCESS CONTROL

The study area during this project will not be one stationary location. Access to private residences will be permitted by the owner. Owners and occupants should be restricted from the immediate areas during sampling procedures. Typically, they should be asked to stay in adjacent rooms during sampling procedures.

9.4 SITE SAFETY INSPECTIONS

The Tetra Tech SSC will conduct periodic site safety inspections to maintain safe work areas and compliance with this HASP. Results of the site safety inspections will be recorded in the field logbook or on a Field Audit Checklist (Form AF-1 in Appendix A).

9.5 SAFE WORK PRACTICES

Various SWPs are applicable during the TAPE project. These SWPs are included in Appendix B to this HASP. The following SWPs apply to the site:

- SWP 6-1, General Safe Work Practices
- SWP 6-8, Safe Electrical Work Practices

- SWP 6-9, Fall Protection Practices
- SWP 6-10, Portable Ladder Safety
- SWP 6-15, Heat Stress
- SWP 6-16, Cold Stress
- SWP 6-27, Respirator Cleaning Procedures
- SWP 6-28, Safe Work Practices for Use of Respirators

10.0 DECONTAMINATION

Decontamination is the process of removing or neutralizing contaminants on personnel or equipment. When properly conducted, decontamination procedures protect workers from contaminants that may have accumulated on PPE, tools, and other equipment. Proper decontamination also prevents transport of potentially harmful materials to uncontaminated areas. Personnel and equipment decontamination procedures are described in the following sections.

10.1 PERSONNEL DECONTAMINATION

Personnel decontamination at the site will be limited by using disposable PPE whenever possible and by wet wiping of faces and hands after sampling procedures. Any personnel decontamination procedures will follow guidance in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH and others 1985). Personnel and PPE will be decontaminated with potable water or a mixture of detergent and water. Disposable cloths or wet wipes will be placed in sealable baggies pending disposal.

10.2 EQUIPMENT DECONTAMINATION

Decontamination of all sampling, PPE, and field monitoring equipment used during site activities will be required. Decontamination of sampling equipment will be conducted at the sample locations. Decontamination procedures will consist of a water rinse or damp rag cleaning of equipment after each sample collected.

10.2.1 PPE and Monitoring Equipment

Used, disposable PPE will be collected in sealable containers and will be disposed of in accordance with procedures described in the project specific work plan. Personnel decontamination procedures may be modified as necessary while on site. All non-disposable PPE such as hard hats, respirators, and any exposed clothing will be washed at the end of each workday, or as necessary depending on working conditions, to remove all potential for asbestos contamination. Monitoring equipment used during sampling will be rinsed with water at the end of each workday, or as necessary to remove any contamination.

10.2.2 Sampling Equipment

Sampling equipment, such as knives and scissors, will be decontaminated before and after each use as described below.

- Decontamination procedures for sampling equipment will depend on the sampling location. Equipment such as knives and scissors will, in most sampling situations, be decontaminated by wiping down with damp cloths or rags. Soap and water may be necessary when items are excessively dirty but are not mandatory.
- Sampling equipment will be allowed to air-dry before the next use.

11.0 EMERGENCY RESPONSE PLANNING

This section describes emergency response planning procedures to be implemented for the site. This section is consistent with local, state, and federal disaster and emergency management plans. The following sections discuss pre-emergency planning, personnel roles and lines of authority, emergency recognition and prevention, evacuation routes and procedures, emergency contacts and notifications, hospital route directions, emergency medical treatment procedures, protective equipment failure, fire or explosion, weather-related emergencies, spills or leaks, emergency equipment and facilities, and reporting.

11.1 PRE-EMERGENCY PLANNING

All on-site employees will be trained in and reminded of the provisions of Section 11.0, site communication systems, and site evacuation routes during the prework briefing and daily tailgate safety meetings. The Tetra Tech SSC will review the emergency response provisions on a regular basis and will be revised, if necessary, to make certain that they are adequate and consistent with prevailing site conditions.

11.2 PERSONNEL ROLES AND LINES OF AUTHORITY

The Tetra Tech SSC has primary responsibility for responding to and correcting emergencies and for taking appropriate measures to maintain the safety of site personnel and the public. Possible actions may include evacuation of personnel from the site area. The SSC is also responsible for ensuring that corrective measures have been implemented, appropriate authorities have been notified, and follow-up reports have been completed.

Individual subcontractors are required to cooperate with the SSC, within the parameters of their scopes of work.

Personnel are required to report all injuries, illnesses, spills, fires, and property damage to the SSC. The SSC must be notified of any on-site emergencies and is responsible for following the appropriate emergency procedures described in this section.

11.3 EMERGENCY RECOGNITION AND PREVENTION

Table 4-1 lists potential on-site chemical hazards, and Table 4-2 provides information on the hazards associated with the various tasks planned for the site. On-site personnel will be made familiar with this information and with techniques of hazard recognition through prework training and site-specific briefings.

11.4 EVACUATION ROUTES AND PROCEDURES

In the event of an emergency that necessitates evacuation of a work task area or the site, the Tetra Tech SSC will contact all nearby personnel using the on-site communication systems discussed in Section 9.1 to advise the personnel of the emergency. The personnel will proceed along site roads to a safe distance upwind from the source of the hazard. The personnel will remain in that area until the SSC or an authorized individual provides further instructions.

11.5 EMERGENCY CONTACTS AND NOTIFICATIONS

The emergency information before Section 1.0 of this HASP provides names and telephone numbers of emergency contact personnel. This page must be posted on site or must be readily available at all times. In the event of a medical emergency, personnel will notify the appropriate emergency organization and will take direction from the Tetra Tech SSC. The project team will follow procedures discussed in Section 11.9 or 11.11.

11.6 HOSPITAL ROUTE DIRECTIONS

Before site activities begin, Tetra Tech personnel will conduct a pre-emergency hospital run to familiarize themselves with the route to the local hospital. A map showing the hospital route is provided in the emergency information before Section 1.0 of this HASP.

11.7 EMERGENCY MEDICAL TREATMENT PROCEDURES

A person who becomes ill or injured during work may require decontamination. If the illness or injury is minor, any decontamination necessary will be completed and first aid should be administered before the patient is transported. If the patient's condition is serious, partial decontamination will be completed (such as complete disrobing of the person and redressing the person in clean coveralls or wrapping in a blanket). First aid should be administered until an ambulance or paramedics arrive. All injuries and illnesses must be reported immediately to the Tetra Tech project manager and HSR.

Any person transported to a clinic or hospital for chemical exposure treatment will be accompanied by information on the chemical he or she has been exposed to at the site, if possible. Table 4-1 contains this information.

11.8 PROTECTIVE EQUIPMENT FAILURE

If any worker in the exclusion zone experiences a failure of protective equipment (either engineering controls or PPE) that affects his or her personal protection, the worker and all coworkers will immediately leave the exclusion zone. Re-entry to the exclusion zone will not be permitted until (1) the protective equipment has been repaired or replaced, (2) the cause of the equipment failure has been determined, and (3) the equipment failure is no longer considered to be a threat.

11.9 FIRE OR EXPLOSION

In the event of a fire or explosion on site, fire department will be immediately summoned. The Tetra Tech SSC or a site representative will advise the fire department of the location and nature of any hazardous materials involved. Appropriate provisions of Section 11.0 will be implemented by site personnel.

11.10 WEATHER-RELATED EMERGENCIES

Work will not be conducted during severe weather conditions, including high-speed winds or lightning. In the event of severe weather, field personnel will stop work, secure and lower all equipment, and leave the site.

Thermal stress caused by excessive heat or cold may occur as a result of extreme temperatures, workload, or the PPE used. Heat and cold stress treatment will be administered as described in SWPs 6-15 and 6-16.

11.11 EMERGENCY EQUIPMENT AND FACILITIES

The following emergency equipment will be available on site:

- First aid kit
- Fire extinguisher
- Site telephones, depending on location
- Mobile telephone
- Confined-space entry equipment, as necessary
- Fall protection equipment, as necessary

11.12 REPORTING

All emergencies require follow-up and reporting. Appendix A includes the Tetra Tech Accident and Illness Investigation Report (Form AR-1). This report must be completed and submitted to the Tetra Tech project manager within 24 hours of an emergency. The project manager will review the report and then forward it to the Tetra Tech HSR for review. The report must include proposed actions to prevent similar incidents from occurring. The HSR must be fully informed of the corrective action process so that she may implement applicable elements of the process at other sites.

REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH). “Threshold Limit Values and Biological Exposure Indices for 1998.” Latest edition.

National Institute for Occupational Safety and Health (NIOSH) and others. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. October.

NIOSH. 1997. “Pocket Guide to Chemical Hazards.” U.S. Department of Health and Human Services. U.S. Government Printing Office. Washington, DC. June.

Tetra Tech, Inc. 1999. “Health and Safety Manual.”

APPENDIX A

TETRA TECH FORMS

(11 Sheets)

- Compliance Agreement (Form HSP-4)
- Daily Tailgate Safety Meeting (Form HST-2)
- Daily Site Log (Form SSC-1)
- Accident and Illness Investigation Report (Form AR-1)
- Field Audit Checklist (Form AF-1)

APPENDIX B

SAFE WORK PRACTICES

(38 Sheets)

- SWP 6-1 General Safe Work Practices
- SWP 6-9 Fall Protection Practices
- SWP 6-10 Portable Ladder Safety
- SWP 6-15 Heat Stress
- SWP 6-16 Cold Stress
- SWP 6-27 Respirator Cleaning Procedures
- SWP 6-28 Safe Work Practices for Use of Respirators

APPENDIX C

RESPIRATORY HAZARD ASSESSMENT (FORM RP-2)

(Two Sheets)

Note: This assessment form will be finalized if gasses or vapors are encountered and is not required for asbestos sampling.

ATTACHMENT D

MATERIAL SAFETY DATA SHEETS

(None Anticipated)

Designation: D 5755 – 95

Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations[1]

This standard is issued under the fixed designation D 5755; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a procedure to (*a*) identify asbestos in dust and (*b*) provide an estimate of the concentration of asbestos in the sampled dust reported as the number of asbestos structures per unit area of sampled surface.

1.1.1 If an estimate of the asbestos mass is to be determined, the user is referred to Test Method D 5756.

1.2 This test method describes the equipment and procedures necessary for sampling, by a microvacuum technique, non-airborne dust for levels of asbestos structures. The non-airborne sample is collected inside a standard filter membrane cassette from the sampling of a surface area for dust which may contain asbestos.

1.2.1 This procedure uses a microvacuuming sampling technique. The collection efficiency of this technique is unknown and will vary among substrates. Properties influencing collection efficiency include surface texture, adhesiveness, electrostatic properties and other factors.

1.3 Asbestos identified by transmission electron microscopy (TEM) is based on morphology, selected area electron diffraction (SAED), and energy dispersive X-ray analysis (EDXA). Some information about structure size is also determined.

1.4 This test method is generally applicable for an estimate of the concentration of asbestos structures starting from approximately 1000 asbestos structures per square centimetre.

1.4.1 The procedure outlined in this test method employs an indirect sample preparation technique. It is intended to disperse aggregated asbestos into fundamental fibrils, fiber bundles, clusters, or matrices that can be more accurately quantified by transmission electron microscopy. However, as with all indirect sample preparation techniques, the asbestos observed for quantification may not represent the physical form of the asbestos as sampled. More specifically, the procedure described neither creates nor destroys asbestos, but it may alter the physical form of the mineral fibers.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1193 Specification for Reagent Water[2]

D 1739 Test Method for the Collection and Measurement of Dustfall (Settleable Particulate Matter)[3]

D 3195 Practice for Rotameter Calibration[3]

D 3670 Guide for Determination of Precision and Bias of Methods of Committee D-22[3]

D 5756 Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Mass Concentration[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *asbestiform*—a special type of fibrous habit in which the fibers are separable into thinner fibers and ultimately into fibrils. This habit accounts for greater flexibility and higher tensile strength than other habits of the same mineral. For more information on asbestiform mineralogy, see Refs **(1)**,[4] **(2)** and **(3)**.

3.1.2 *asbestos*—a collective term that describes a group of naturally occurring, inorganic, highly fibrous, silicate dominated minerals, which are easily separated into long, thin, flexible fibers when crushed or processed.

3.1.2.1 *Discussion*—Included in the definition are the asbestiform varieties of: serpentine (chrysotile); riebeckite (crocidolite); grunerite (grunerite asbestos); anthophyllite (anthophyllite asbestos); tremolite (tremolite asbestos); and actinolite (actinolite asbestos). The amphibole mineral compositions are

[1] This test method is under the jurisdiction of ASTM Committee D-22 on Sampling and Analysis of Atmospheresand is the direct responsibility of Subcommittee D22.07on Sampling and Analysis of Asbestos.

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[2] *Annual Book of ASTM Standards*, Vol 11.01.

[3] *Annual Book of ASTM Standards*, Vol 11.03.

[4] The boldface numbers in parentheses refer to the list of references at the end of this test method.

defined according to nomenclature of the International Mineralogical Association **(3)**.

Asbestos	Chemical Abstract Service No.[5]
Chrysotile	12001-29-5
Crocidolite	12001-28-4
Grunerite Asbestos	12172-73-5
Anthophyllite Asbestos	77536-67-5
Tremolite Asbestos	77536-68-6
Actinolite Asbestos	77536-66-4

3.1.3 *fibril*—a single fiber that cannot be separated into smaller components without losing its fibrous properties or appearance.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aspect ratio*—the ratio of the length of a fibrous particle to its average width.

3.2.2 *bundle*—a structure composed of three or more fibers in a parallel arrangement with the fibers closer than one fiber diameter to each other.

3.2.3 *cluster*—a structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group; groupings of fibers must have more than two points touching.

3.2.4 *debris*—materials that are of an amount and size (particles greater than 1 mm in diameter) that can be visually identified as to their source.

3.2.5 *dust*—any material composed of particles in a size range of ≤1 mm and large enough to settle by virtue of their weight from the ambient air (see definition for settleable particulate matter in Test Method D 1739).

3.2.6 *fiber*—a structure having a minimum length of 0.5 µm, an aspect ratio of 5:1 or greater, and substantially parallel sides **(4)**.

3.2.7 *fibrous*—of a mineral composed of parallel, radiating, or interlaced aggregates of fibers, from which the fibers are sometimes separable. That is, the crystalline aggregate may be referred to as fibrous even if it is not composed of separable fibers, but has that distinct appearance. The term fibrous is used in a general mineralogical way to describe aggregates of grains that crystallize in a needle-like habit and appear to be composed of fibers. Fibrous has a much more general meaning than asbestos. While it is correct that all asbestos minerals are fibrous, not all minerals having fibrous habits are asbestos.

3.2.8 *indirect preparation*—a method in which a sample passes through one or more intermediate steps prior to final filtration.

3.2.9 *matrix*—a structure in which one or more fibers, or fiber bundles that are touching, are attached to, or partially concealed by a single particle or connected group of nonfibrous particles. The exposed fiber must meet the fiber definition (see 3.2.6).

3.2.10 *structures*—a term that is used to categorize all the types of asbestos particles which are recorded during the analysis (such as fibers, bundles, clusters, and matrices). Final results of the test are always expressed in asbestos structures per square centimetre.

[5] The non-asbestiform variations of the minerals indicated in 5.1.3 have different Chemical Abstract Service (CAS) numbers.

4. Summary of Test Method

4.1 The sample is collected by vacuuming a known surface area with a standard 25 or 37 mm air sampling cassette using a plastic tube that is attached to the inlet orifice which acts as a nozzle. The sample is transferred from inside the cassette to an aqueous solution of known volume. Aliquots of the suspension are then filtered through a membrane. A section of the membrane is prepared and transferred to a TEM grid using the direct transfer method. The asbestiform structures are identified, sized, and counted by TEM, using SAED and EDXA at a magnification of 15 000 to 20 000X.

5. Significance and Use

5.1 This microvacuum sampling and indirect analysis method is used for the general testing of non-airborne dust samples for asbestos. It is used to assist in the evaluation of dust that may be found on surfaces in buildings such as ceiling tiles, shelving, electrical components, duct work, carpet, etc. This test method provides an index of the concentration of asbestos structures in the dust per unit area analyzed as derived from a quantitative TEM analysis.

5.1.1 This test method does not describe procedures or techniques required to evaluate the safety or habitability of buildings with asbestos-containing materials, or compliance with federal, state, or local regulations or statutes. It is the user's responsibility to make these determinations.

5.1.2 At present, a single direct relationship between asbestos-containing dust and potential human exposure does not exist. Accordingly, the user should consider these data in relationship to other available information in their evaluation.

5.2 This test method uses the definition, settleable particulate material, found in Test Method D 1739 as the definition of dust. This definition accepts all particles small enough to pass through a 1 mm (No. 18) screen. Thus, a single, large asbestos containing particle(s) (from the large end of the particle size distribution) dispersed during sample preparation may result in anomalously large asbestos concentration results in the TEM analyses of that sample. It is, therefore, recommended that multiple independent samples are secured from the same area, and a minimum of three samples analyzed by the entire procedure.

6. Interferences

6.1 The following minerals have properties (that is, chemical or crystalline structure) which are very similar to asbestos minerals and may interfere with the analysis by causing a false positive to be recorded during the test. Therefore, literature references for these materials must be maintained in the laboratory for comparison to asbestos minerals so that they are not misidentified as asbestos minerals.

6.1.1 *Antigorite*.

6.1.2 *Palygorskite (Attapulgite)*.

6.1.3 *Halloysite*.

6.1.4 *Pyroxenes*.

6.1.5 *Sepiolite*.

6.1.6 *Vermiculite scrolls*.

6.1.7 *Fibrous talc*.

6.1.8 Hornblende and other amphiboles other than those listed in 3.1.2.

6.2 Collecting any dust particles greater than 1 mm in size in this test method may cause an interference and, therefore, must be avoided.

7. Materials and Equipment

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.[6]

7.2 *Transmission Electron Microscope (TEM)*, an 80 to 120 kV TEM, capable of performing electron diffraction, with a fluorescent screen inscribed with calibrated gradations, is required. The TEM must be equipped with energy dispersive X-ray spectroscopy (EDXA) and it must have a scanning transmission electron microscopy (STEM) attachment or be capable of producing a spot size of less than 250 nm in diameter in crossover.

7.3 *Energy Dispersive X-ray System (EDXA)*.

7.4 *High Vacuum Carbon Evaporator*, with rotating stage.

7.5 *High Efficiency Particulate Air (HEPA)*, filtered negative flow hood.

7.6 *Exhaust or Fume Hood*.

7.7 *Particle-free Water* (ASTM Type II, see Specification D 1193).

7.8 *Glass Beakers* (50 mL).

7.9 *Glass Sample Containers*, with wide mouth screw cap (200 mL) or equivalent sealable container (height of the glass sample container should be approximately 13 cm high by 6 cm wide).

7.10 *Waterproof Markers*.

7.11 *Forceps* (tweezers).

7.12 *Ultrasonic Bath*, table top model (100 W).

7.13 *Graduated Pipettes* (1, 5, 10 mL sizes), glass or plastic.

7.14 *Filter Funnel*, either 25 mm or 47 mm, glass or disposable. Filter funnel assemblies, either glass or disposable plastic, and using either a 25 mm or 47 mm diameter filter.

7.15 *Side Arm Filter Flask*, 1000 mL.

7.16 *Mixed Cellulose Ester (MCE) Membrane Filters*, 25 or 47 mm diameter, ≤0.22 µm and 5 µm pore size.

7.17 *Polycarbonate (PC) Filters*, 25 or 47 mm diameter, ≤0.2 µm pore size.

7.18 *Storage Containers*, for the 25 or 47 mm filters (for archiving).

7.19 *Glass Slides*, approximately 76 by 25 mm in size.

7.20 *Scalpel Blades*, No. 10, or equivalent.

7.21 *Cabinet-type Desiccator*, or low temperature drying oven.

7.22 *Chloroform*, reagent grade.

7.23 *Acetone*, reagent grade.

7.24 *Dimethylformamide (DMF)*.

7.25 *Glacial Acetic Acid*.

7.26 *1-methyl-2-pyrrolidone*.

7.27 *Plasma Asher*, low temperature.

7.28 *pH Paper*.

7.29 *Air Sampling Pump*, low volume personal-type, capable of achieving a flow rate of 1 to 5 L/min.

7.30 *Rotameter*.

7.31 *Air Sampling Cassettes*, 25 mm or 37 mm, containing 0.8µ m or smaller pore size MCE or PC filters.

7.32 *Cork Borer*, 7 mm.

7.33 *Non-Asbestos Mineral*, references as outlined in 6.1.

7.34 *Asbestos Standards*, as outlined in 3.1.2.

7.35 *Tygon*[7] *Tubing*, or equivalent.

7.36 *Small Vacuum Pump*, that can maintain a pressure of 92 kPa.

7.37 *Petri Dishes*, large glass, approximately 90 mm in diameter.

7.38 *Jaffe Washer*, stainless steel or aluminum mesh screen, 30 to 40 mesh, and approximately 75 mm by 50 mm in size.

7.39 *Copper TEM Finder Grids*, 200 mesh.

7.40 *Carbon Evaporator Rods*.

7.41 *Lens Tissue*.

7.42 *Ashless Filter Paper Filters*, 90 mm diameter.

7.43 *Gummed Paper Reinforcement Rings*.

7.44 *Wash Bottles*, plastic.

7.45 *Reagent Alcohol*, HPLC Grade (Fisher A995 or equivalent).

7.46 *Opening Mesh Screen*, plastic, 1.0 by 1.0 mm, (Spectra-Mesh #146410 or equivalent).

7.47 *Diffraction Grating Replica*.

8. Sampling Procedure for Microvacuum Technique

8.1 For sampling asbestos-containing dust in either indoor or outdoor environments, commercially available cassettes must be used. Air monitoring cassettes containing 25 mm or 37 mm diameter mixed cellulose ester (MCE) or polycarbonate (PC) filter membranes with a pore size less than or equal to 0.8 µm are required (7.31). The number of samples collected depends upon the specific circumstances of the study.

8.2 Maintain a log of all pertinent sampling information and sampling locations.

8.3 Sampling pumps and flow indicators shall be calibrated using a certified standard apparatus or assembly (see Practice D 3195 and 7.29).

8.4 Record all calibration information **(5)**.

8.5 Perform a leak check of the sampling system at each sampling site by activating the pump (7.29) with the closed sampling cassette in line. Any air flow shows that a leak is present that must be eliminated before initiating the sampling operation.

8.6 Attach the sampling cassette to the sampling pump at the outlet side of the cassette with plastic tubing (7.35). The plastic tubing must be long enough in that the sample areas can

[6] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.

[7] Tygon is a registered trademark of the DuPont Co.

be reached without interference from the sampling pump. Attach a clean, approximately 25.4 mm long piece of plastic tubing (6.35 mm internal diameter) directly to the inlet orifice. Use this piece of tubing as the sampling nozzle. Cut the sampling end of the tubing at a 45° angle as illustrated in Fig. 1. The exact design of the nozzle is not critical as long as some vacuum break is provided to avoid simply pushing the dust around on the surface with the nozzle rather than vacuuming it into the cassette. The internal diameter of the nozzle and flow rate of the pump may vary as long as the air velocity is 100 (±10) cm/s. This air velocity calculation is based on an internal sampling tube diameter of 6.35 mm at a flow rate of 2 L/min.

8.7 Measure and determine the sample area of interest. A sample area of 100 cm^2 is vacuumed until there is no visible dust or particulates matter remaining. Perform a minimum of two orthogonal passes on the surface within a minimum of 2 min of sampling time. Avoid scraping or abrading the surface being sampled. (Do not sample any debris or dust particles greater than 1 mm in diameter (see 4.2).) Smaller or larger areas can be sampled, if needed. For example, some surfaces of interest may have a smaller area than 100 cm^2. Less dusty surfaces may require vacuuming of larger areas. Unlike air samples, the overloading of the cassettes with dust will not be a problem. As defined in 3.2.5, only dust shall be collected for this analysis.

8.8 At the end of sample collection, invert the cassette so that the nozzle inlet faces up before shutting off the power to the pump. The nozzle is then sealed with a cassette end-plug and the cassette/nozzle taped or appropriately packaged to prevent separation of the nozzle and cassette assembly. A second option is the removal of the nozzle from the cassette, then plugging of the cassette and shipment of the nozzle (also plugged at both ends) sealed in a separate closeable plastic bag. A third option is placing the nozzle inside the cassette for shipment. The nozzle is always saved and rinsed because a significant percentage of the dust drawn from a lightly loaded surface may adhere to the inside walls of the tubing.

8.9 Check that all samples are clearly labeled, that all dust sampling information sheets are completed, and that all pertinent information has been enclosed, in accordance with laboratory quality control practices, before transfer of the samples to the laboratory. Include an unused cassette and nozzle as a field blank.

8.10 Wipe off the exterior surface of the cassettes with disposable wet towels (baby wipes) prior to packaging for shipment.

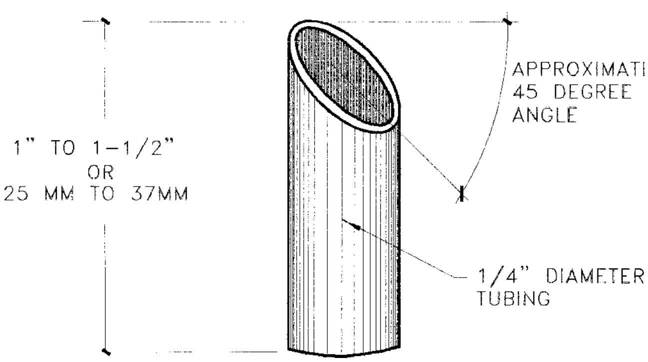

FIG. 1 Example of the Tubing Nozzle

9. Sample Shipment

9.1 Ship dust samples to an analytical laboratory in a sealed container, but separate from any bulk or air samples. The cassettes must be tightly sealed and packed in a material free of fibers or dust to minimize the potential for contamination. Plastic "bubble pack" is probably the most appropriate material for this purpose.

10. Sample Preparation

10.1 Under a negative flow HEPA hood (7.5), carefully wet-wipe the exterior of the cassettes to remove any possible contamination before taking cassettes into a clean preparation area.

10.2 Perform sample preparation in a clean facility that has a separate work area from both the bulk and air sample preparation areas.

10.3 Initial specimen preparation shall take place in a clean HEPA filtered negative pressure hood to avoid any possible contamination of the laboratory or personnel, or both, by the potentially large number of asbestos structures in an asbestos-containing dust sample. Cleanliness of the preparation area hoods is measured by the cumulative process blank concentrations (see Section 11).

10.4 All sample preparation steps 10.4.1-10.4.6 shall take place in the dust preparation area inside a HEPA hood.

10.4.1 Remove the upper plug from the sample cassette and carefully introduce approximately 10 mL solution of a 50/50 mixture of particle-free water and reagent alcohol into the cassette using a plastic wash bottle (7.44). If the plugged nozzle was left attached to the cassette, then remove the plug and introduce the water/alcohol solution into the cassette through the tubing, and then remove the tubing, if it is visibly clean.

10.4.2 Replace the upper plug or the sample cap and lightly shake the dust suspension by hand for 3 s.

10.4.3 Remove the entire cap of the cassette and pour the suspension through a 1.0 by 1.0 mm opening screen (7.46) into a pre-cleaned 200 mL glass specimen bottle (7.9). All visible traces of the sample contained in the cassette shall be rinsed through the screen into the specimen bottle with a plastic wash bottle containing the 50/50 solution of particle-free water and alcohol. Repeat this procedure two additional times for a total of three washings. Next, rinse the nozzle two or three times through the screen into the specimen bottle with the 50/50 mixture of water and alcohol. Typically, the total amount of the 50/50 mixture used in the rinse is 50 to 75 mL. Discard the 1.0 by 1.0 mm screen and bring the volume of solution in the specimen bottle up to the 100 mL mark on the side of the bottle with particle-free water only.

10.4.4 Adjust the pH of the suspension to 3 to 4 using a 10.0 % solution of acetic acid. Use pH paper for testing. Filter the suspension within 24 h to avoid problems associated with bacterial and fungal growth.

10.4.5 Use either a disposable plastic filtration unit or a glass filtering unit (7.14) for filtration of aliquots of the suspension. The ability of an individual filtration unit to produce a uniform distribution may be tested by the filtration of a colored particulate suspension such as diluted India ink (suspension of carbon black).

10.4.5.1 If a disposable plastic filtration unit is used, then unwrap a new disposable plastic filter funnel unit (either 25 or 47 mm diameter) and remove the tape around the base of the funnel. Remove the funnel and discard the top filter supplied with the apparatus, retaining the coarse polypropylene support pad in place. Assemble the unit with the adapter and a properly sized neoprene stopper, and attach the funnel to the 1000 mL side-arm vacuum flask (7.15). Place a 5.0 µ m pore size MCE (backing filter) on the support pad. Wet it with a few mL of particle-free water and place an MCE (7.16) or PC filter (≤0.22 µm pore size) (7.17) on top of the backing filter. Apply a vacuum (7.36), ensuring that the filters are centered and pulled flat without air bubbles. Any irregularities on the filter surface requires the discard of that filter. After the filter has been seated properly, replace the funnel and reseal it with the tape. Return the flask to atmospheric pressure.

10.4.5.2 If a glass filtration unit is used, place a 5 µm pore size MCE (backing filter) on the glass frit surface. Wet the filter with particle-free water, and place an MCE or PC filter (≤0.22 µm pore size) on top of the backing filter. Apply a vacuum, ensuring that the filters are centered and pulled flat without air bubbles. Replace the filters if any irregularities are seen on the filter surface. Before filtration of each set of sample aliquots, prepare a blank filter by filtration of 50 mL of particle-free water. If aliquots of the same sample are filtered in order of increasing concentration, the glass filtration unit need not be washed between filtration. After completion of the filtration, do not allow the filtration funnel assembly to dry because contamination is then more difficult to remove. Wash any residual suspension from the filtration assembly by holding it under a flow of water, then rub the surface with a clean paper towel soaked in a detergent solution. Repeat the cleaning operation, and then rinse two times in particle-free water.

10.4.6 With the flask at atmospheric pressure, add 20 mL of particle-free water into the funnel. Cover the filter funnel with its plastic cover if the disposable filtering unit is used.

10.4.7 Briefly hand shake (3 s) the capped bottle with the sample suspension, then place it in a tabletop ultrasonic bath (7.12) and sonicate for 3.0 min. Maintain the water level in the sonicator at the same height as the solution in sample bottle. The ultrasonic bath shall be calibrated as described in 20.5. The ultrasonic bath must be operated at equilibrium temperature. After sonicating, return the sample bottle to the work surface of the HEPA hood. Preparation steps 10.4.8-10.4.14 shall be carried out in this hood.

10.4.8 Shake the suspension lightly by hand for 3 s, then let it rest for 2.0 min to allow large particles to settle to the bottom of the bottle or float to the surface.

10.4.9 Estimate the amount of liquid to be withdrawn to produce an adequate filter preparation. Experience has shown that a light staining of the filter surface will yield a suitable preparation for analysis. Filter at least 1.0 mL, but no more than half the total volume. If after examination in the TEM, the smallest volume measured (1.0 mL) (7.13) yields an overloaded sample, then perform additional serial dilutions of the suspension. If it is estimated that less than 1.0 mL of solution has to be filtered because of the density of the suspension, perform a serial dilution.

10.4.9.1 If serial dilutions are required, repeat step 10.4.8 before the serial dilution portion is taken. Do not re-sonicate the original solution or any serial dilutions. The recommended procedure for a serial dilution is to mix 10 mL of the sample solution with 90 mL of particle-free water in a clean sample bottle to obtain a 1:10 serial dilution. Follow good laboratory practices when performing dilutions.

10.4.10 Insert a new disposable pipette halfway into the sample suspension and withdraw a portion. Avoid pipetting any of the large floating or settled particles. Uncover the filter funnel and dispense the mixture from the pipette into the water in the funnel.

10.4.11 Apply vacuum to the flask and draw the mixture through the filter.

10.4.12 Discard the pipette.

10.4.13 Disassemble the filtering unit and carefully remove the sample filter with fine tweezers (7.11). Place the completed sample filter particle side up, into a precleaned, labeled, disposable, plastic petri dish (7.48) or other similar container.

10.4.14 In order to ensure that an optimally-loaded filter is obtained, it is recommended that filters be prepared from several different aliquots of the dust suspension. For this series of filters, it is recommended that the volume of each aliquot of the original suspension be a factor of five higher than the previous one. If the filters are prepared in order of increasing aliquot volume, all of the filters for one sample can be prepared using one plastic disposable filtration unit, or without cleaning of glass filtration equipment between individual filtration. Before withdrawal of each aliquot from the sample, shake the suspension without additional sonification and allow to rest for 2 min.

10.4.15 There are many practical methods for drying MCE filters. The following are two examples that can be used: (*1*) dry MCE filters for at least 12 h (over desiccant) in an airtight cabinet-type desiccator (7.21); (*2*) to shorten the drying time (if desired), remove a plug of the damp filter and attach it to a glass slide (7.19) as described in 12.1.2 and 12.1.3. Place the slide with a filter plug or filter plugs (up to eight plugs can be attached to one slide) on a bed of desiccant, in the desiccator for 1 h.

10.4.16 PC filters do not require lengthy drying before preparation, but shall be placed in a desiccator for at least 30 min before preparation.

10.5 Prepare TEM specimens from small sections of each dried filter using the appropriate direct transfer preparation method.

11. Blanks

11.1 Prepare sample blanks that include both a process blank (50 mL of particle-free water) for each set of samples analyzed and one unused filter from each new box of sample filters (MCE or PC) used in the laboratory. If glass filtering units are used, prepare and analyze a process blank each time the filtering unit is cleaned. Blanks will be considered contaminated, if after analysis, they are shown to contain more than 53 asbestos structures per square millimetre. This generally corresponds to three or four asbestos structures found in ten grid openings. The source of the contamination must be found before any further analysis can be performed. Reject samples that were processed along with the contaminated blanks and prepare new samples after the source of the contamination is found.

11.2 Prepare field blanks which are included with sample sets in the same manner as the samples, to test for contamination during the sampling, shipping, handling, and preparation steps of the method.

12. TEM Specimen Preparation of Mixed Cellulose Ester (MCE) Filters

NOTE 1—Use of either the acetone or the diamethylformamide-acetic acid method is acceptable.

12.1 *Acetone Fusing Method*:

12.1.1 Remove a section (a plug) from any quadrant of the sample and blank filters. Sections can be removed from the filters using a 7 mm cork borer (7.32). The cork borer must be wet wiped after each time a section is removed.

12.1.2 Place the filter section (particle side up) on a clean microscope slide. Affix the filter section to the slide with a gummed page reinforcement (7.43), or other suitable means. Label the slide with a glass scribing tool or permanent marker (7.10).

12.1.3 Prepare a fusing dish from a glass petri dish (7.37) and a metal screen bridge (7.38) with a pad of five to six ashless paper filters (7.42) and place in the bottom of the petri dish **(4)**. Place the screen bridge on top of the pad and saturate the filter pads with acetone. Place the slide on top of the bridge in the petri dish and cover the dish. Wait approximately 5 min for the sample filter to fuse and clear.

12.2 *Dimethylformamide-Acetic Acid Method*:

12.2.1 Place a drop of clearing solution that consists of 35 % dimethylformamide (DMF), 15 % glacial acetic acid, and 50 % Type II water (v/v) on a clean microscope slide. Gauge the amount used so that the clearing solution just saturates the filter section.

12.2.2 Carefully lay the filter segment, sample surface upward, on top of the solution. Bring the filter and solution together at an angle of about 20° to help exclude air bubbles. Remove any excess clearing solution. Place the slide in an oven or on a hot plate, in a fume hood, at 65 to 70°C for 10 min.

12.3 Plasma etching of the collapsed filter is required.

12.3.1 The microscope slide to which the collapsed filter pieces are attached is placed in a plasma asher (7.27). Because plasma ashers vary greatly in their performance, both from unit to unit and between different positions in the asher chamber, it is difficult to specify the exact conditions that must be used. Insufficient etching will result in a failure to expose embedded fibers, and too much etching may result in the loss of particles from the filter surface. To determine the optimum time for ashing, place an unused 25 mm diameter MCE filter in the center of a glass microscope slide. Position the slide approximately in the center of the asher chamber. Close the chamber and evacuate to a pressure of approximately 40 Pa, while admitting oxygen to the chamber at a rate of 8 to 20 cm^3/min. Adjust the tuning of the system so that the intensity of the plasma is maximized. Determine the time required for complete oxidation of the filter. Adjust the system parameters to achieve complete oxidation of the filter in a period of approximately 15 min. For etching of collapsed filters, use these operating parameters for a period of 8 min. For additional information on calibration, see the *USEPA Asbestos-Containing Materials in Schools* **(4)** or *NIST/NVLAP Program Handbook for Airborne Asbestos Analysis* **(6)** documents.

12.3.2 Place the glass slide containing the collapsed filters into the low-temperature plasma asher, and etch the filter.

12.4 Carbon coating of the collapsed and etched filters is required.

12.4.1 Carbon coating must be performed with a high-vacuum coating unit (7.4), capable of less than 10^{-4} torr (13 MPa) pressure. Units that are based on evaporation of carbon filaments in a vacuum generated only by an oil rotary pump have not been evaluated for this application and shall not be used. Carbon rods (7.40) used for evaporators shall be sharpened with a carbon rod sharpener to a neck of about 4 mm in length and 1 mm in diameter. The rods are installed in the evaporator in such a manner that the points are approximately 100 to 120 mm from the surface of the microscope slide held in the rotating device.

12.4.2 Place the glass slide holding the filters on the rotation device, and evacuate the evaporator chamber to a vacuum of at least 13 MPa. Perform the evaporation in very short bursts, separated by 3 to 4 s to allow the electrodes to cool. An alternate method of evaporation is by using a slow continuous applied current. An experienced analyst can judge the thickness of the carbon film to be applied. Conduct tests on unused filters first. If the carbon film is too thin, large particles will be lost from the TEM specimen, and there will be few complete and undamaged grid openings on the specimen.

12.4.2.1 If the coating is too thick, it will lead to a TEM image that is lacking in contrast, and the ability to obtain electron diffraction patterns will be compromised. The carbon film shall be as thin as possible and still remain intact on most of the grid openings of the TEM specimen.

12.5 *Preparation of the Jaffe Washer*— The precise design of the Jaffe washer is not considered important, so any one of the published designs may be used **(7, 8)**. One such washer consists of a simple stainless steel bridge contained in a glass petri dish.

12.5.1 Place several pieces of lens tissue (7.41) on the stainless steel bridge. The pieces of lens tissue shall be large enough to completely drape over the bridge and into the solvent. In a fume hood, fill the petri dish with acetone (or DMF) until the height of the solvent is brought up to contact the underside of the metal bridge as illustrated in Fig. 2.

12.6 *Placing the Specimens into the Jaffe Washer*:

12.6.1 Place the TEM grids (7.39) shiny side up on a piece of lens tissue or filter paper so that individual grids can be easily picked up with tweezers.

12.6.2 Prepare three grids from each sample.

12.6.2.1 Using a curved scalpel blade (7.20), excise at least two square (3 mm by 3 mm) pieces of the carbon-coated MCE filter from the glass slide.

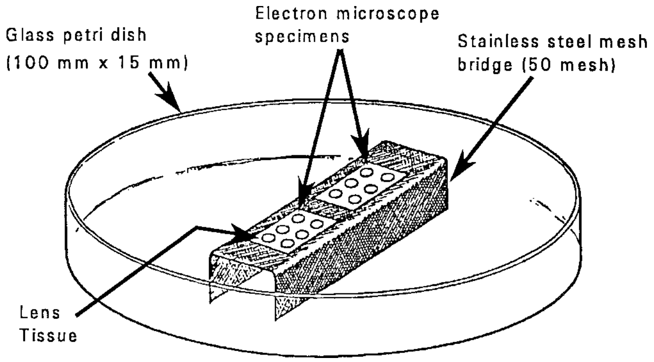

FIG. 2 Example of Design of Solvent Washer (Jaffe Washer)

12.6.2.2 Place the square filter piece carbon-side up on top of a TEM specimen grid.

12.6.2.3 Place the whole assembly (filter/grid) on the saturated lens tissue in the Jaffe washer.

12.6.2.4 Place the three TEM grid sample filter preparations on the same piece of lens tissue in the Jaffe washer.

12.6.2.5 Place the lid on the Jaffe washer and allow the system to stand for several hours.

12.7 Alternately, place the grids on a low level (petri dish filled to the ⅛ mark) DMF Jaffe washer for 60 min. Add enough solution of equal parts DMF/acetone to fill the washer to the screen level. Remove the grids after 30 min if they have cleared, that is, all filter material has been removed from the carbon film, as determined by inspection in the TEM.

12.8 Carefully remove the grids from the Jaffe washer, allowing the grids to dry before placing them in a clean marked grid box.

13. TEM Specimen Preparation of Polycarbonate (PC) Filter

13.1 Cover the surface of a clean microscope slide with two strips of double-sided adhesive tape.

13.2 Cut a strip of filter paper slightly narrower than the width of the slide. Position the filter paper strip on the center of the length of the slide.

13.3 Using a clean, curved scalpel blade, cut a strip of the PC filter approximately 25 by 6 mm. Use a rocking motion of the scalpel blade to avoid tearing the filter. Place the PC strip particle side up on the slide perpendicular to the long axis of the slide. The ends of the PC strip must contact the double sided adhesive tape. Each slide can hold several PC strips. With a glass marker, label each PC strip with the individual sample number.

13.4 Carbon coat the PC filter strips as discussed in 12.4.2. PC filters do not require etching.

NOTE 2—**Caution:** Do not overheat the filter sections while carbon coating.

13.5 Prepare a Jaffe washer as described in 12.5, but fill the washer with chloroform or 1-methyl-2-pyrrolidone to the level of the screen.

13.6 Using a clean curved scalpel blade, excise three, 3-mm square filter pieces from each PC strip. Place the filter squares carbon side up on the shiny side of a TEM grid. Pick up the grid and filter section together and place them on the lens tissue in the Jaffe washer.

13.7 Place the lid on the Jaffe washer and rest the grids in place for at least 4 h. Best results are obtained with longer wicking times, up to 12 h.

13.8 Carefully remove the grids from the Jaffe washer, allowing the grids to dry before placing them in a clean, marked grid box.

14. Grid Opening Measurements

14.1 TEM grids must have a known grid opening area. Determine this area as follows:

14.2 Measure at least 20 grid openings in each of 20 random 75 to 100 µm (200-mesh) copper grids for a total of 400 grid openings for every 1000 grids used, by placing the 20 grids on a glass slide and examining them under the optical microscope. Use a calibrated graticule to measure the average length and width of the 20 openings from each of the individual grids. From the accumulated data, calculate the average grid opening area of the 400 openings.

14.3 Grid area measurements can also be made at the TEM at a calibrated screen magnification of between 15 000 and 20 000X. Typically measure one grid opening for each grid examined. Measure grid openings in both the x and y directions and calculate the area.

14.4 Pre-calibrated TEM grids are also acceptable for this test method.

15. TEM Method

15.1 Microscope settings: 80 to 120 kV, 15 000 to 20 000X screen magnification for analysis (7.2).

15.2 Analyze two grids for each sample. Analyze one-half of the sample area on one sample grid preparation and the remaining half on a second sample grid preparation.

15.3 *Determination of Specimen Suitability*:

15.3.1 Carefully load the TEM grid, carbon side facing up (in the TEM column) with the grid bars oriented parallel/perpendicular to the length of the specimen holder. Use a hand lens or loupe, if necessary. This procedure will line up the grid with the X and y translation directions of the microscope. Insert the specimen holder into the microscope.

15.3.2 Scan the entire grid at low magnification (250X to 1000X) to determine its suitability for high magnification analysis as specified in 15.3.3.

15.3.3 Grids are acceptable for analysis if the following conditions are met:

15.3.3.1 The fraction of grid openings covered by the replica section is at least 50 %.

15.3.3.2 Relative to that section of the grid covered by the carbon replica, the fraction of intact grid openings is greater than 50 %.

15.3.3.3 The fractional area of undissolved filter is less than 10 %.

15.3.3.4 The fraction of grid openings with overlapping or folded replica film is less than 50 %.

15.3.3.5 At least 20 grid openings, that have no overlapping or folded replica, are less than 5 % covered with holes and have less than 5 % opaque area due to incomplete filter dissolution.

15.4 *Determination of Grid Opening Suitability*:

15.4.1 If the grid meets acceptance criteria, choose a grid opening for analysis from various areas of the grid so that the entire grid is represented. Determine the suitability of each individual grid opening prior to the analysis.

15.4.2 The individual grid opening must have less than 5 % holes over its area.

15.4.3 Grid openings must be less than 25 % covered with particulate matter.

15.4.4 Grid openings must be uniformly loaded.

15.5 Observe and record the orientation of the grid at 80 to 150X, on a grid map record sheet along with the location of the grid openings that are examined for the analysis. If indexed grids are used, a grid map is not required, but the identifying coordinates of the grid square must be recorded.

16. Recording Data Rules

16.1 Record on the count sheet any continuous grouping of particles in which an asbestos fiber is detected. Classify asbestos structures as fibers, bundles, clusters, or matrices as defined in 5.2.

16.2 Use the criteria for fiber, bundle, cluster, and matrix identification, as described in the *USEPA Asbestos-Containing Materials in Schools* document **(4)**. Record, for each AHERA structure identified, the length and width measurements.

16.3 Record NSD (No Structures Detected) when no structures are detected in the grid opening.

16.4 Identify structures classified as chrysotile identified by either electron diffraction or X-ray analysis (7.3) and recorded on a count sheet. Verify at least one out of every ten chrysotile structures by X-ray analysis.

16.5 Structures classified as amphiboles by X-ray analysis and electron diffraction are recorded on the count sheet. For more information on identification, see Yamate, et al, **(7)** or Chatfield and Dillon **(8)**.

16.6 Record a typical electron diffraction pattern for each type of asbestos observed for each group of samples (or a minimum of every five samples) analyzed. Record the micrograph number on the count sheet. Record at least one X-ray spectrum for each type of asbestos observed per sample. Attach the print-outs to the back of the count sheet. If the X-ray spectrum is stored, record the file and disk number on the count sheet.

16.7 *Counting Rules*:

16.7.1 At a screen magnification of between 15 000 and 20 000X evaluate the grids for the most concentrated sample loading; reject the sample if it is estimated to contain more than 50 asbestos structures per grid opening. Proceed to the next lower concentrated sample until a set of grids are obtained that have less than 30 asbestos structures per grid opening.

16.8 *Analytical Sensitivity*—An analytical sensitivity of approximately 1000 asbestos structures per square centimetre (calculated for the detection of a single asbestos structure) has been designed for this analysis. This sensitivity can be achieved by increasing the amount of liquid filtered, increasing the number of grid openings analyzed, or decreasing the size of the final filter. Occasionally, due to high particle loadings or high asbestos concentration, this analytical sensitivity cannot be practically achieved and stopping rules apply.

16.9 *Limit of Detection*—The limit of detection for this method is defined as, at a minimum, the counting of four asbestos structures during the TEM analysis. If less than four asbestos structures are counted during the analysis then the analytical result which will be reported will be less than the limit of detection and a “less than” sign (<) will appear before the number. All data shall be provided in the laboratory report.

16.10 *Stopping Rules*:

16.10.1 The analysis is stopped upon the completion of the grid square that achieves an analytical sensitivity of less than 1000 asbestos structures per square centimetre.

16.10.2 If an analytical sensitivity of 1000 asbestos structures per square centimetre cannot be achieved after analyzing ten grid openings then stop on grid opening No. 10 or the grid opening which contains the 100th asbestos structure, whichever comes first. A minimum of four grid squares shall be analyzed for each sample.

16.10.2.1 If the analysis is stopped because of the 100th structure rule, the entire grid square containing the 100th structure must be counted.

16.11 After analysis, remove the grids from the TEM, and replace them in the appropriate grid storage holder.

17. Sample Storage

17.1 The washed-out sample cassettes can be discarded after use.

17.2 Sample grids and unused filter sections (7.18) must be stored for a minimum of one year.

18. Reporting

18.1 Report the following information for each dust sample analyzed:

18.1.1 Concentration in structures/cm^2.

18.1.2 The analytical sensitivity.

18.1.3 Types of asbestos present.

18.1.4 Number of asbestos structures counted.

18.1.5 Effective filtration area.

18.1.6 Average size of the TEM grid openings that were counted.

18.1.7 Number of grid openings examined.

18.1.8 Sample dilution used.

18.1.9 Area of the surface sampled.

18.1.10 Listing of size data for each structure counted.

18.1.11 A copy of the TEM count sheet or a complete listing of the raw data. An example of a typical count sheet is shown in Appendix X1.

18.2 Determine the amount of asbestos in any accepted sample using the following formula:

$$\frac{EFA \times 100 \text{ mL} \times \#STR}{GO \times GOA \times V \times SPL} = \text{asbestos structures/cm}^2 \qquad (1)$$

where:

$\#STR$ = number of asbestos structures counted,
EFA = effective filter area of the final sampling filter, mm^2,
GO = number of grid openings counted,
GOA = average grid opening area, mm^2,
SPL = surface area sampled, cm^2, and
V = volume of sample filtered in step 10.4.9, representing the actual volume taken from the original 100 mL suspension, mL.

19. Quality Control/Quality Assurance

19.1 In general, the laboratory's quality control checks are used to verify that a system is performing according to specifications regarding accuracy and consistency. In an analytical laboratory, spiked or known quantitative samples are normally used. However, due to the difficulties in preparing known quantitative asbestos samples, routine quality control testing focuses on re-analysis of samples (duplicate recounts).

19.1.1 Re-analyze samples at a rate of 1⁄10 of the sample sets (one out of every ten samples analyzed not including laboratory blanks). The re-analysis shall consist of a second sample preparation obtained from the final filter.

19.2 In addition, quality assurance programs must follow the criteria shown in the *USEPA Asbestos-Containing Materials in Schools* document **(4)** and in the *NIST/NVLAP Program Handbook for Airborne Asbestos Analysis* document **(6)**. These documents describe sample custody, sample preparation, blank checks for contamination, calibration, sample analysis, analyst qualifications, and technical facilities.

20. Calibrations

20.1 Perform calibrations of the instrumentation on a regular basis, and retain these records in the laboratory, in accordance with the laboratory's quality assurance program.

20.2 Record calibrations in a log book along with dates of calibration and the attached backup documentation.

20.3 A calibration list for the instrument is as follows:

20.3.1 *TEM*:

20.3.1.1 Check the alignment and the systems operation. Refer to the TEM manufacturer's operational manual for detailed instructions.

20.3.1.2 Calibrate the camera length of the TEM in electron diffraction (ED) operating mode before ED patterns of unknown samples are observed. Camera length can be measured by using a carbon coated grid on which a thin film of gold has been sputtered or evaporated. A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis ED patterns superimposed with a ring pattern from the polycrystalline gold film. In practice, it is desirable to optimize the thickness of the gold film so that only one or two sharp rings are obtained on the superimposed ED pattern. Thick gold films will tend to mask weak diffraction spots from the fibrous particles. Since the unknown d-spacings of most interest in asbestos analysis are those which lie closest to the transmitted beam, multiple gold rings from thick films are unnecessary. Alternatively, a gold standard specimen can be used to obtain an average camera constant calculated for that particular instrument and can then be used for ED patterns of unknowns taken during the corresponding period.

20.3.1.3 Perform magnification calibration at the fluorescent screen. This calibration must be performed at the magnification used for structure counting. Calibration is performed with a grating replica (7.47) (for example, one containing at least 2160 lines/mm).

(a) (*a*) Define a field of view on the fluorescent screen. The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric).

(b) (*b*) Frequency of calibration will depend on the service history of the particular microscope.

(c) (*c*) Check the calibration after any maintenance of the microscope that involves adjustment of the power supply to the lens or the high voltage system or the mechanical disassembly of the electron optical column (apart from filament exchange).

(d) (*d*) The analyst must ensure that the grating replica is placed at the same distance from the objective lens as the specimen.

(e) (*e*) For instruments that incorporate a eucentric tilting specimen stage, all specimens and the grating replica must be placed at the eucentric position.

20.3.1.4 The smallest spot size of the TEM must be checked.

(a) (*a*) At the crossover point, photograph the spot size at a screen magnification of 15 000 to 20 000X. An exposure time of 1 s is usually adequate.

(b) (*b*) The measured spot size must be less than or equal to 250 nm.

20.4 *EDXA*:

20.4.1 The resolution and calibration of the EDXA must be verified.

20.4.1.1 Collect a standard EDXA Cu peak from the Cu grid.

20.4.1.2 Compare the X-ray energy versus channel number for the Cu peak and be certain that readings are within ±10 eV.

20.4.2 Collect a standard EDXA of crocidolite asbestos (NIST SRM 1866).

20.4.2.1 The elemental analysis of the crocidolite must resolve the Na peak.

20.4.3 Collect a standard EDXA of chrysotile asbestos.

20.4.3.1 The elemental analysis of chrysotile must resolve both Si and Mg on a single chrysotile fiber.

20.5 Ultrasonic bath calibration shall be performed as follows:

20.5.1 Fill the bath water to a level equal to the height of suspension in the glass sample container that will be used for the dust analysis. Operate the bath until the water reaches the equilibrium temperature.

20.5.2 Place 100 mL of water (at approximately 20°C) in another 200-mL glass sample container, and record its temperature.

20.5.3 Place the sample container in the water in the ultrasonic bath (with the power turned off). After 60 s, remove the glass container and record its temperature.

20.5.4 Place 100 mL of water (at approximately 20°C) in another 200-mL glass sample container, and record its temperature.

20.5.5 Place the second sample container into the water in the ultrasonic bath (with the power turned on). After 60 s, remove the glass container and record its temperature.

20.5.6 Calculate the rate of energy deposition into the sample container using the following formula:

$$R = 4.185 \times \sigma \times \rho \times \frac{(\theta_2 - \theta_1)}{t} \quad (2)$$

where:

4.185	=	Joules/cal,
R	=	energy deposition, watts/mL,

θ_1 = temperature rise with the ultrasonic bath not operating, °C,
θ_2 = temperature rise with the ultrasonic bath operating, °C,
t = time in seconds, 60 s (20.5.3 and 20.5.5),
σ = specific heat of the liquid in the glass sample container, 1.0 cal/g, and
ρ = density of the liquid in the glass sample container, 1.0 g/cm^3.

20.5.7 Adjust the operating conditions of the bath so that the rate of energy deposition is in the range of 0.08 to 0.12 MW/m^3, as defined by this procedure.

21. Precision and Bias

21.1 *Precision*—The precision of the procedure in this test method is being determined using round robin data from participating laboratories.

21.2 *Bias*—Since there is no accepted reference material suitable for determining the bias of the procedure in this test method, bias has not been determined (see Specification D 3670).

NOTE 3—Round robin data is under development and will be presented as a research report.

22. Keywords

22.1 asbestos; microvacuuming; settled dust; TEM

APPENDIX

(Nonmandatory Information)

X1. DUST SAMPLE ANALYSIS

X1.1 See Figs. X1.1 and X1.2 for the dust analysis worksheet and the TEM count sheet.

DUST SAMPLE ANALYSIS

Client:	________	Accelerating Voltage:	________
Sample ID:	________	Indicated Mag:	KX
Job Number:	________	Screen Mag:	KX
Date Sample Analyzed:	- -	Microscope:	1 2 3 4 5
Number of Openings/Grids Counted:	|	Filter Type:	________
Grid Accepted, 600X:	Yes No	Filter Size:	________
Percent Loading:	%	Filter Pore Size (μm):	________
Grid Box #1:	________	Grid Opening:	1) μm x μm
			2) μm x μm

Analyst: ________

Reviewer: ________

Counting Rules: AHERA LEVEL II

Calculation Data:

Effective Filter Area in mm^2:	(EFA)	________
Number of Grid Openings Counted:	(GO)	________
Avderage Grid Opening Area in mm^2:	(GOA)	________
Volume of sample Filtered in ml:	(V)	________
Surface area Sampled in cm^2:	(SPL)	________
Number of Asbestos Structures Counted:*	(#STR)	________

* If the number of asbestos structures counted is less than or equal to 4, enter 4 structures as the limit of detection here.

FORMULA FOR CALCULATION OF ASBESTOS STRUCTURES "DUST" PER CM^2:

$$\frac{\text{EFAX} \times 100 \times \#\text{STR}}{\text{GO} \times \text{GOA} \times \text{VX SPL}} = \text{(Asbestos Structures per cm}^2\text{)}$$

Results for Total Asbestos Structures: ________
(Structures per cm^2)

Results for Structures ≥ microns: ________
(Structures per cm^2)

FIG. X1.1 Dust Sample Analysis Work Sheet

Job Number: ______________________________

Structure #	Grid # Square #	Type	Structure	Length Microns	Width Microns	Confirmation		
						Morph.	SAED	EDS

Note: Keys to Abbreviations Used in Figure:

Type:

C = Chrysotile
AM = Amosite
CR = Crocidolite
AC = Actinolite
TR = Tremolite
AN = Anthophyllite
N = Non Asbestos

Structure:

F = Fiber
B = Bundle
C = Cluster
M = Matrix

Others:

NSD = No Structures Detected
Morph = Morphology
SAED = Selected Area Electron Diffraction
EDS = Energy Dispersive X-Ray Spectroscopy
ER = Inter-Row Spacing
NP = No Pattern

FIG. X1.2 TEM Count Sheet

REFERENCES

(**1**) Steel, E. and Wylie, A., "Mineralogical Characteristics of Asbestos," in *Geology of Asbestos Deposits*, Riordon, P. H., Ed., SME-AIME, 1981, pp. 93–101.

(**2**) Zussman, J., "The Mineralogy of Asbestos," in *Asbestos: Properties, Applications and Hazards*, John Wiley and Sons, 1979, pp. 45–67.

(**3**) Leake, B. E., "Nomenclature of Amphiboles," *American Mineralogist*, Vol 63, 1978, pp. 1023–1052.

(**4**) " *USEPA Asbestos-Containing Materials in Schools: Final Rule and Notice," Federal Register*, 40 CFR Part 763, Appendix A to Sub-part E., Oct. 30, 1987.

(**5**) OSHA, *OSHA Technical Manual*, *OSHA Instruction CPL 2-20B*, Directorate of Technical Support, U.S. Department of Labor, Washington, DC 20210, Feb. 5, 1990, pp. 1–8 to 1–11.

(**6**) *NIST/NVLAP Program Handbook for Airborne Asbestos Analysis*, NISTIR, August 1989, pp. 89–4137.

(**7**) Yamate, G., Agarwall, S. C., and Gibbons, R. D., "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy," EPA Draft Report, Contract No. 68-02-3266, 1984.

(**8**) Chatfield, E. J., and Dillon, M. J., "Analytical Method for the Determination of Asbestos in Water," EPA No. 600/4-83-043, 1983.

Standard Practice for Comprehensive Building Asbestos Surveys[1]

This standard is issued under the fixed designation E 2356; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This standard practice describes procedures for conducting comprehensive surveys of buildings and facilities for the purpose of locating, identifying, quantifying and assessing asbestos-containing materials.

1.2 The results of a Comprehensive Building Asbestos Survey are intended to be used for ongoing management of asbestos-containing materials, including Operations & Maintenance, removal and other response actions. This includes response actions associated with renovations. A Comprehensive Building Asbestos Survey is also intended to provide information required for removal of asbestos-containing materials prior to demolition of a building or facility.

1.3 This standard practice discusses two types of surveys: Baseline Surveys and Project Design Surveys.

1.4 This standard practice discusses the following activities for each of the above types of surveys:

1.4.1 Planning the survey to meet defined objectives;

1.4.2 Obtaining and reviewing information on the building or facility including previous surveys and response actions;

1.4.3 Conducting the physical activities of inspecting the premises and collecting bulk samples of suspect materials;

1.4.4 Analyzing the bulk samples for asbestos type and content;

1.4.5 Assessing the Current Condition and Potential for Disturbance of asbestos-containing materials; and

1.4.6 Preparing a report that includes a narrative discussion of the findings, tabulations of inspection, sampling and analysis results, graphical depiction of the areas inspected, and the results of the assessment.

1.5 A Comprehensive Building Asbestos Survey provides sufficient information about the asbestos-containing materials in a building or facility for purposes of a real property transaction. In situations where the amount of information required by a party to the transaction is minimal, a Limited Asbestos Screen may suffice in place of the Comprehensive Building Asbestos Survey.

1.6 This standard practice does not include air sampling or surface (dust) sampling for purposes of evaluating a potential exposure hazard from airborne asbestos fibers.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

E 631 Terminology of Building Constructions

E 736 Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

E 1368 Practice for Visual Inspection of Asbestos Abatement Projects

E 1494 Practice for Encapsulants for Spray-or-Trowel- Applied Friable Asbestos-Containing Building Materials

Manual on Asbestos Control: Removal, Management, and the Visual Inspection Process, Manual No. 23, November 1995

2.2 *Other Documents:*

EPA 560/5-85-024 Guidance for Controlling Asbestos-Containing Materials in Buildings. ("Purple Book") 1985[3]

EPA 560/5-85-030A Asbestos in Buildings: Simplified Sampling Scheme for Surfacing Materials.("Pink Book") 1985[3]

EPA 20T-2003 Managing Asbestos in Place: A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials. ("Green Book") July, 1990[3]

EPA-600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials. June, 1993[3]

40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants: Subpart M—Asbestos[3]

[1] This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.24 on Building Preservation and Rehabilitation Technology.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

40 CFR Part 763, Subpart E Asbestos-Containing Materials in Schools (EPA AHERA Regulations)[3]
40 CFR Part 763, Subpart E, Appendix C (EPA Model Accreditation Plan)[3]
29 CFR 1910.1001 Occupational Exposure to Asbestos (OSHA General Industry Standard)[3]
29 CFR 1915.1001 Occupational Exposure to Asbestos (OSHA Shipyard Standard)[3]
29 CFR 1926.1101 Occupational Exposure to Asbestos (OSHA Construction Standard)[3]
State of New York Environmental Laboratory Approval Program (ELAP) Certification Manual, Item No. 198.1 Polarized Light Microscopy Method for identifying and Quantifying Asbestos in Non-Friable Organically Bound Bulk Samples, May 15, 2000[4]
State of New York Environmental Laboratory Approval Program (ELAP) Certification Manual, Item No. 198.4 Transmission Electron Microscopy Method for identifying and Quantifying Asbestos in Non-Friable Organically Bound Bulk Samples, March 1, 1997[4]
Guidance Manual: Asbestos Operations and Maintenance Work Practices[5]
Asbestos Abatement and Management in Buildings: Model Guide Specification[5]

3. Terminology

3.1 *Definitions*—For definitions of building terms, see Terminology E 631.

3.2 *Terms Defined in Practice E 1368*—The user is referred to Practice E 1368 for terms specifically related to asbestos abatement for purposes of a Project Design Survey.

3.2.1 *asbestos-containing materials*, *n*—material containing more than one percent asbestos.

3.2.1.1 *surfacing material*, *n*—material that is sprayed, troweled-on, or otherwise applied to interior and exterior structural and architectural surfaces. Surfacing material includes acoustical plaster on ceilings, fireproofing on structural members, textured paint and exterior stucco, and other materials applied to surfaces for acoustical, decorative, fireproofing and other purposes.

3.2.1.2 *thermal system insulation*, *n*—material which is applied to interior and exterior mechanical components to reduce heat gain or loss. Thermal system insulation includes insulation on pipes, fittings, boilers, breeching, tanks, ducts, and other mechanical components.

3.2.1.3 *miscellaneous materials*, *n*—material, other than surfacing material and thermal system insulation, on interior and exterior structural, mechanical, electrical, or architectural components and surfaces. Miscellaneous material includes but is not limited to ceiling tiles, gaskets, floor coverings and mastics, wallboard joint compound, roofing materials, and cementitious products.

3.2.2 *crawl space*, *n*—an accessible area that may have a dirt floor, usually with low head room.

3.2.3 *dust and debris*, *n*—visible particles, fragments, or chunks of material, large enough to have settled in the work area by virtue of their weight, that are presumed to have originated from the material abated by the response action, or from a fiber release episode.

3.2.4 *fiber release episode*, *n*—uncontrolled or unintentional disturbance of asbestos-containing materials which results in the generation of dust and debris.

3.2.5 *friable material*, *n*—material easily crumbled or powdered by moderate (hand) pressure.

3.2.6 *response action*, *n*—a method of abatement (such as removal, encapsulation, or enclosure) or operations and maintenance (such as repair, clean-up, or preventive measures) of asbestos-containing material in any form, for any purpose whatsoever.

3.2.7 *visual inspection process*, *n*—the activities before, during, and at the conclusion of a response action that are associated with detecting the presence of visible residue, dust and debris, or unremoved material and verifying the absence thereof at the completion of a response action.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *asbestos*, *n*—the asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite (amosite), anthophyllite, and actinolite-tremolite.

3.3.2 *accessible location*, *n*—a functional space or part thereof that can be inspected without requiring destructive testing or presenting an unacceptable health or safety risk to the inspector, and where entry is not prohibited by security or other institutional restrictions.

3.3.3 *building asbestos survey*, *n*—an activity to determine the presence, location, condition, and quantity of asbestos-containing materials in a building or facility, or on the property containing the building or facility.

3.3.4 *bulk sample*, *n*—a sample of suspect asbestos-containing material collected for identification of asbestos and determination of the percent of the components in the sample.

3.3.5 *laboratory*, *n*—an entity that is equipped and qualified to perform one or more of the following analyses, using approved methods: *(1)* identify and quantify asbestos in bulk samples by Polarized Light Microscopy; *(2)* identify and quantify asbestos in bulk samples by Transmission Electron Microscopy, *(3)* identify and quantify airborne fibers with Phase Contrast Microscopy.

3.3.6 *non-friable organically bound (NOB) materials*, *n*—materials that are not friable and that consist of fibers and other particulate matter embedded in a solid matrix of asphaltic, vinyl or other organic substances.

3.3.7 *operations and maintenance (O&M) program*, *n*—a proactive management program to provide periodic surveillance of asbestos-containing materials, maintain them in good condition, mitigate fiber release from existing asbestos-containing materials, and clean up asbestos-containing dust and debris that has been released, in order to minimize worker or occupant exposure to asbestos fibers.

3.3.8 *destructive testing*, *n*—inspection procedures that necessarily involve objectionable or noticeable damage to building surfaces, or require penetration of a surface such as a wall,

[4] Availble from the Environmental Laboratory Approval Program, Wadsworth Center, P.O. Box 509, Albany, NY 12201.

[5] Available from National Institute of Building Sciences (NIBS), 1090 Vermont Avenue, NW, Suite 700 Washington, DC 20005-4905.

ceiling, chase or shaft to gain access to a concealed space. Lifting a ceiling tile or opening a hatch is not destructive testing.

3.3.9 *functional space*, *n*—an area within a building or facility that is used for a specific purpose. Examples include a warehouse in a manufacturing plant and a conference room in an office building. A functional space can be vertical in extent, such as a pipe chase, and span several floors.

3.3.10 *homogeneous area*, *n*—surfacing material, thermal system insulation material, or miscellaneous material that is uniform in color and texture, and apparent or known date of installation.

3.3.11 *polarized light microscopy (PLM)*, *n*—a method of analytical mineralogy that uses an optical microscope to determine the optical properties of sample constituents and, in the case of bulk sample analysis for asbestos, to provide positive identification of suspect fibers as asbestos and to quantify the percent of asbestos in the sample.

3.3.12 *suspect material*, *n*—material that is sampled or is presumed to contain asbestos on the basis of its location, purpose, appearance and other factors considered by the inspector.

3.4 *Acronyms:*

3.4.1 *ACM*—Asbestos-containing material(s)

3.4.2 *AHERA*—Asbestos Hazard Emergency Response Act

3.4.3 *EPA*—U.S. Environmental Protection Agency

3.4.4 *HEPA*—High Efficiency Particulate Air

3.4.5 *NAD*—No Asbestos Detected

3.4.6 *NESHAP*—National Emission Standards for Hazardous Air Pollutants; specifically, the National Emission Standard for Asbestos (40 CFR Part 61, Subpart M)

3.4.7 *NOB*—Non-friable organically-bound

3.4.8 *OSHA*—U.S. Department of Labor, Occupational Safety and Health Administration

3.4.9 *PPE*—Personal Protective Equipment

3.4.10 *PLM*—Polarized Light Microscopy

3.4.11 *TEM*—Transmission Electron Microscopy

4. Significance and Use

4.1 Management of asbestos-containing materials in buildings and facilities requires knowledge of the location, type, quantity, and condition of the material. The more complete and accurate the information available, the more appropriate and cost-effective are the control measures used to reduce possible exposure to airborne asbestos fibers. This is true whether the asbestos-containing materials remain undisturbed and completely intact, are selectively removed for maintenance or prior to renovation, or are removed to the greatest extent feasible before demolishing the building or facility.

4.2 This standard practice describes two types of surveys that support different objectives. These are the Baseline Survey and the Project Design Survey.

4.2.1 The Baseline Survey is a building-wide or facility-wide inspection that provides a general sense of the overall location, type, quantity, and condition of asbestos-containing materials present. It is thorough in that most accessible functional spaces are inspected and bulk samples taken of suspect materials observed. The baseline survey provides information for long-term management of asbestos-containing materials and prioritization of response actions. The presence of asbestos in suspect materials may be assumed or presumed in some cases without bulk samples being taken or analyzed. However, the baseline survey is unobtrusive in that samples are not taken where doing so would result in objectionable damage to surfaces or where institutional barriers preclude access. In a baseline survey, destructive testing is avoided.

NOTE 1—A Baseline Survey is sometimes called an "AHERA" survey because it provides the type of information used for management of asbestos-containing materials in schools. However, the baseline survey described in this standard practice requires inspection, bulk sampling, quantification and assessment and suspect materials that are excluded by virtue of their type and location from the AHERA regulations for schools.

NOTE 2—Suspect material subject to disturbance by planned or emergency maintenance may not always be identified as to asbestos content in a Baseline Survey. Collecting a single bulk sample, or a small number of samples, to determine if the material contains asbestos does not constitute a survey within the meaning of this standard practice. Nonetheless, the sample(s) should be collected according to the methods described in Appendix X1 (this must be done by a properly-credentialed individual) and analyzed as set forth in 6.5.

4.2.2 The Project Design Survey is more focused than a Baseline Survey and is used to provide information to the Project Designer for preparing abatement plans and specifications. The locations inspected are limited to the areas that will be affected by the abatement project. If the project is being done prior to renovation or demolition, the construction plans or at least a clear statement of the scope of the renovation or demolition work are required for a proper Project Design Survey. Destructive testing is often required for a Project Design Survey. The presence of asbestos in suspect materials is always confirmed in a Project Design Survey rather than being assumed or presumed. Other information required for the Project Design is collected during the survey.

4.3 An asbestos survey may be required to meet the EPA NESHAP notification requirements for renovation or demolition, or be required by governmental agencies for issuance of a building permit. The Project Design Survey is most appropriate for this purpose. Posting of signs and labels required for compliance with OSHA regulations would use the information generated during a Baseline Survey.

4.4 This standard practice emphasizes the concept that a Comprehensive Building Asbestos Survey consists of more than the collection and analysis of samples, and the report is more than a compilation of laboratory results. It is important to inspect as many functional spaces as possible and to document the reasons why certain functional spaces were not inspected and locations where no suspect materials were observed and, consequently, no samples were taken. Reasons might include access limitations, the absence of materials to sample, the existence of information from previous surveys, or the availability of reliable documentation such as Material Safety Data Sheets.

4.5 A Comprehensive Building Asbestos Survey is not limited to the class of materials commonly referred to as asbestos-containing building materials (ACBM), defined in the AHERA regulations as "... found in or on interior structural members or other parts of a building." Items that are difficult to distinguish as such may include cooling towers, laboratory hoods, gaskets, chalkboards and other articles. These may be installed in, attached to, or adjacent to the building or facility but are not as clearly a part of the building or facility as fireproofing or floor tile. Nonetheless, such items still fall within the scope of an asbestos management program and therefore are addressed in this standard practice. Locations outside the building, in particular equipment in industrial facilities and power plants, and crawl spaces underneath the building are within the scope of a Comprehensive Building Asbestos Survey.

4.6 This standard practice is intended to be used by individuals who are conducting a Comprehensive Building Asbestos Survey for the owner or manager of a building or facility under a contractual arrangement for services as well as by employees of the owner or manager. If the individual is conducting the survey under a contractual arrangement (which may be with the firm employing the individual), the owner or manager of the building is still responsible for certain activities as described in this standard practice.

5. Qualifications and Responsibilities

5.1 This section describes the qualifications and responsibilities of the individuals who participate in the Comprehensive Building Asbestos Survey. The requirement for accreditation as an Inspector according to the Model Accreditation Plan applies to the activities covered by this standard practice. Additional accreditations may be required, and qualifications may be imposed by state licensing requirements or the policies of the owner or manager of the building or facility that are beyond the scope of this standard practice. Field experience in performing asbestos building surveys as described in this practice is of paramount importance.

5.2 Not all of the qualifications discussed herein will be required for every Comprehensive Building Asbestos Survey conducted, and in many cases one individual (usually the accredited inspector) will have more than one, and possibly all, of the required credentials.

5.3 Qualifications and responsibilities of individuals conducting the survey:

5.3.1 *Accredited Inspector*—For both types of surveys, accreditation as an Inspector is required for the individual who takes the bulk samples and otherwise performs the physical activities comprising the survey. This includes review of relevant building documentation and preparation of the survey report.

5.3.2 *Management Planner*—For a baseline survey, accreditation as a management planner is only required for hazard assessment and determination of response actions if the survey is performed in a school, but is a desirable credential for all buildings and facilities.

5.3.3 *Project Designer*—For a project design survey, accreditation as a project designer is desirable because this survey will provide information for the plans and specifications to be used on an abatement project.

5.3.4 *Contractor/Supervisor*—For a project design survey, accreditation as a contractor/supervisor would be helpful because of the knowledge of abatement processes such an individual possesses.

5.4 In addition to the above accreditations, the following credentials are evidence of the ability to perform one or more of the aspects of a Comprehensive Building Asbestos Survey.

5.4.1 Credentials that indicate knowledge of building design include experience in building design, construction, or operations and academic degree(s), licensure or registration as an architect or engineer. Academic degree(s) or certification in industrial hygiene, occupational safety or a related field indicates knowledge of the hazardous properties of asbestos and other substances as well as the means of controlling the hazards.

5.4.2 Credentials that indicate knowledge of building construction and operations include field experience in building construction, renovation, demolition, or maintenance, or a combination thereof; or formal or on-the-job training in construction technology or management.

5.5 Qualifications and responsibilities of owner or manager of building or facility: To be able to provide the necessary information, access, and other support to the inspector(s), the staff of the building or facility owner or manager should have taken at least a two-hour Asbestos Awareness course.

5.6 Laboratories analyzing the samples shall possess one or more of the following qualifications in addition to, or as part of, any applicable state licensing requirements:

5.6.1 For bulk sample analysis using Polarized Light Microscopy,

5.6.1.1 Accreditation by the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology (NIST);

5.6.1.2 Participation in the American Industrial Hygiene Association (AIHA) Bulk Asbestos Proficiency Analytical Testing Program;

5.6.1.3 Certification under the State of New York Environmental Laboratory Approval Program (ELAP);[4] and

5.6.1.4 Participation in a proficiency testing and certification program similar to 5.6.1.1-5.6.1.3.

5.6.2 For bulk sample analysis of NOBs using Transmission Electron Microscopy, the laboratory shall be certified under the State of New York Environmental Laboratory Approval Program (ELAP) or provide other evidence of capability and experience with the ELAP method[4] or its equivalent acceptable to the consultant.

5.6.3 For air sample analysis using Phase Contrast Microscopy, the laboratory shall demonstrate current proficiency in the NIOSH Proficiency Analytical Testing program administered by the American Industrial Hygiene Association. Accreditation for asbestos analysis by the AIHA is also desirable but not mandatory.

6. Baseline Surveys

6.1 *Planning the Survey*—In today's litigious environment, it is essential that the planning stage of an asbestos survey not only be complete in addressing the following issues, but be documented in a way that will defend, if necessary, the inspector and/or the building owner. It is not possible for the asbestos inspector to anticipate the reasons project performance may be legally questioned (that is, a change in the financial condition of the building owner; a change in the real estate market; and so forth). Every asbestos inspection should be planned as if it will be questioned, and, consequently, it should be defensible. A well-planned survey will consider other Environmental Health & Safety issues that could be addressed during the survey and will consult other appropriate professionals, trades, or knowledgeable individuals who may provide valuable information regarding systems included in the survey. Typical, non-renovation/demolition surveys will incorporate portions of each of these types of surveys to develop a comprehensive Baseline Survey.

6.1.1 *Establishing the Purpose of the Survey*—The purpose of the Baseline Survey is to identify suspect asbestos-containing materials as defined in the scope of the survey. Management of the ACM will include normal Operations and Maintenance activities over a long term and will include prioritizing asbestos hazards for the purpose of planning future abatement activities. If the inspection is for pending demolition or renovation activities, see Section 7 on Project Design Surveys.

6.1.2 *Deciding who Conducts the Survey*—Whether the inspection is conducted by an outside consultant or in-house staff, the inspector shall be properly-credentialed as an asbestos building inspector by either federal EPA or an EPA approved state program under the Model Accreditation Plan. The inspector may also be required to be licensed by the State, City and/or local jurisdiction of the inspection.

6.1.2.1 In-house staff should have a more intimate knowledge of the locations of suspect materials, and the use and occupancy of the areas containing those materials. Bulk sample collection by in-house inspectors may be useful when dealing with emergency repairs or planning operations and maintenance activities when only a few bulk samples are required. However, in-house staff usually has other responsibilities that may preclude the timely completion of a baseline survey, and may not have the experience necessary to perform a thorough survey.

6.1.2.2 The outside consultant should have insurance covering asbestos operations to insulate the owner from potential liability. In most cases, conflict of interest issues would be best avoided by using an outside consultant. Typically, outside consultants can complete a survey in a more timely fashion and provide a more thorough and unbiased report than in-house personnel. Additionally, building owners and managers can benefit from the consultant's experience gained while inspecting other facilities.

6.1.3 *Establishing the Scope of the Survey*—It is essential that the inspector have documented, in writing, the exact scope of work for which he is responsible. A Baseline Survey would normally be comprehensive in nature. However, if the inspection is to be limited to certain buildings, or portions of buildings, the specific areas to be inspected must be documented in order for the inspector to achieve substantial completion of the contract, and not be held responsible for further work. One of the most important functions in-house personnel can provide is to participate in determining the purpose of the survey, planning the survey and reviewing the results of the inspection done by the outside consultant. In house personnel should also play a role with providing access to all areas of the building/facility to the survey team(s) and be available to answer questions posed by the survey team and the building occupants.

6.1.3.1 Identify buildings, or portions of buildings to be inspected. Each individual building shall be inspected separately and all functional spaces inspected, whether or not bulk samples are taken therein. A separate set of homogeneous areas of suspect material shall be identified, sampled or assumed and determined to be ACM or non-ACM per building. A homogeneous area may not be extended to include more than one building, but may include components exterior to a building such as cooling towers, vessels and piping. Data forms, supplies and equipment must be sufficient to address multiple buildings if necessary.

6.1.3.2 ACM should be identified in the Baseline Survey regardless of whether it is used as a construction material or not, and whether located inside, outside or underneath the building, as long as the area inspected is within the scope of survey. This should specifically include stored materials such as gaskets, packing or insulation not yet installed in or on the facility.

6.1.3.3 In some industrial facilities, there may be gaskets, packing and other ACM installed in equipment (such as furnaces) that is not part of the building systems (such as HVAC). The equipment may be in operation at the time of the survey, or the suspected ACM may be inaccessible for other reasons. For example, the inspector may lack the tools and skills to properly disassemble the equipment for access to the suspected ACM. The scope of work for the survey should be clear as to whether this equipment is to be inspected and under what circumstances. The most convenient, and often the safest, time to inspect such equipment is when it is out of service for maintenance or while production is interrupted. The plant manager should make a list of equipment with suspect ACM and the plant's O&M plan should specify if and when gaskets, packing, etc. are to be sampled.

NOTE 3—Gaskets are usually installed in bolted flange fittings. If only one or two fittings are being worked with, the gaskets can be presumed to be asbestos-containing material (PACM) and the employee instructed to follow appropriate procedures. For such small-scale work, it may be faster and cheaper to follow these procedures rather than to sample and analyze the gaskets. If an inspector were to sample for demolition purposes, the same restrictions would apply. In a demolition situation, it makes more sense to cut the pipe, leave the fittings intact, and dispose of them.

6.1.4 *Inspection Requirements*—A typical scope of work for an asbestos survey will address the following topics: survey protocol, what materials will be sampled, what materials will be presumed/assumed (floor tiles, floor tile mastic, roofing materials, gaskets and packings), what materials will not be included in the survey, quantification of materials, areas of the building/facility to be surveyed, access to specific areas of the building/facility (high ceilings, vaults, computer rooms, roofs, etc.), areas of the building/facility not to be surveyed (pipe chases, wall cavities, roofs), numbers of samples, quality control, follow-up analyses (point-counting, TEM), time schedules, and deliverables (reporting, reporting format, floor plans or drawing, and so forth). Bulk sampling shall be done to prove that the material in question is not ACM. Otherwise the suspect material shall be presumed to be ACM, and documented and managed accordingly. (See Appendix X1, Sampling Techniques and Equipment)

6.1.4.1 Under this standard practice, a minimum of three bulk samples representative of each different homogeneous area of suspect material to be sampled shall be collected and analyzed to prove that the material sampled is not ACM. See 6.4.6.1 for specific minimum numbers of samples by type of suspect material. Situations that call for more than the accepted minimum should be called to the attention of the building owner.

6.1.4.2 Field notebooks should include forms for the collection of information as follows: a complete list and location of functional spaces to be inspected (see 6.4.2); bulk sample logs (see 6.4.3); a complete list and location of suspect materials and homogeneous areas (see 6.4.5); chain of custody (see 6.4.9.1); assessment information (see 6.6). Samples of forms are provided in Appendix X3, Field Data Collection Forms.

6.1.4.3 Destructive inspections (opening walls/ceilings, multiple layers of flooring, etc.) are not performed on a Baseline Survey and therefore concealed suspect materials are not directly sampled, assessed or quantified. However, the inspector may, if specifically requested by the building owner, indirectly infer the location, quantity and condition of concealed suspect materials on the basis of information from accessible confirmed ACM that appears to be part of the same homogeneous area. In this case the concealed material will be treated as ACM. The assumptions on which such extrapolations are based should be clearly spelled out in the survey report.

6.1.5 *Analytical Requirements*—At a minimum, PLM shall be used to analyze bulk samples, as required by both OSHA and EPA. A laboratory qualified according to 5.6.1 should be used. A determination shall be made initially that all samples required to be collected, will be analyzed.

NOTE 4—A time and money saving technique used by some inspectors commonly referred to as "positive stop" is the practice of instructing the laboratory to stop analyses of all samples in a given homogeneous sampling area when one of the samples is found to contain greater than one percent asbestos. This practice may have application when performing Baseline Surveys for the management of ACMs over time. However if this technique is used, the resulting work practices and management program should be structured to adequately control both serpentine and amphibole asbestos. It is possible, and very likely, under the "positive stop" practice to not properly characterize the type and quantity of asbestos in the sample. One should not conclude that based on one analysis, the homogeneous area contains low concentrations of asbestos or even only one type of asbestos, be it serpentine or amphibole. Additionally, areas of non-asbestos containing materials may be identified as ACM when employing the "positive stop" practice due to misidentification of homogeneous areas (see 6.5.3.3). Additional sampling is recommended to fully characterize the asbestos content of the entire homogeneous area when performing the Baseline survey.

6.1.5.1 The determination of whether a sample is ACM or non-ACM shall be consistent with EPA and OSHA definitions: Greater than 1 % is ACM; 1 % or less is not ACM. Samples that are reported to contain detectable amounts of asbestos (for example, trace, <1 %, or 1 %) shall be re-analyzed by the PLM point count technique. If the point count analyses is reported to contain one-percent or less of asbestos, the sample shall be considered to be non-ACM. The determination of whether a homogeneous area of suspect material is ACM or non-ACM shall be consistent with EPA AHERA at 40 CFR 763.87(c): "A homogeneous area is considered not to contain ACM only if the results of all samples required to be collected from the area show asbestos in the amounts of 1 % or less."

6.1.5.2 PLM analyses of non-friable organically bound (NOB) materials such as tar, roofing materials, mastic, glue, and floor tile are frequently reported as being negative for asbestos when in fact significant quantities of asbestos are contained within the material. At least one sample of each distinct homogeneous area of NOB materials shall be re-analyzed by quantitative transmission electron microscopy with gravimetric reduction when all samples in the homogeneous area sample set are reported to be one percent or less asbestos by PLM. The inspector should be familiar with the regulations in the local, state, or county government in which the survey is being performed as some locales require all NOB samples to be analyzed by TEM.

6.1.6 *Survey Report*—A survey report will be generated that should include, at a minimum, the date of the inspection and report, the accreditation number and dates of accreditation for the inspector(s) conducting the survey, identification, quantification and location of all suspect material, an indication of whether the material is ACM or non-ACM, assessment information on condition of ACM, and how the ACM relates to building function. The survey report will include a complete laboratory report detailing the analysis of each bulk sample analyzed. Applicable sections of this Standard Practice, including appendices, should be referenced in the report (see 6.7).

6.1.7 *Schedule*—A schedule must be coordinated with the building owner that will provide access as necessary for a preliminary site visit, as well as the performance of the comprehensive survey. Contractual issues on completion of work and submission of report must also be addressed as planning issues.

6.1.7.1 Preliminary site visits may be scheduled at any time, and should give the inspector an indication of the type and variety of suspect materials present, the scope or extent of the work, and normal use and occupancy of various areas of the facility. Typically the preliminary site visit provides the inspector(s) the opportunity to become familiar with a building/facility and provides an opportunity to ask questions affecting the performance of the survey to develop a cost proposal for the completion of the survey.

6.1.7.2 Bulk sampling activities should be scheduled when the functional spaces to be inspected are unoccupied. This may mean night or weekend work, as the case may be. An inspector shall not disturb suspect material in the unprotected presence of building occupants. Facilities that operate on a 24-h basis may have to isolate or demarcate areas for sampling, or assume all identified suspect materials in areas that may not be isolated to be ACM. Because OSHA regulations requires respirator and protective clothing use in the absence of a negative exposure assessment, sampling in unoccupied areas is least troublesome to both the building owner as well as the inspector. Security systems and/or escort may also have to be coordinated with the owner.

6.2 *Estimating the Cost of the Survey—Estimated Cost of Survey*—Many factors affect the cost of performing a comprehensive asbestos survey. Some of these factors may vary over time and may be dependent upon regional, state, or other economic factors such as salaries, benefits, cost of living, and the economic condition of the companies, nation, or individuals performing the survey or laboratory analyses. This standard does not attempt to identify or address those issues. This standard attempts to identify the most common components that affect the cost of performing a comprehensive asbestos survey. Companies or individuals purchasing asbestos survey services should clearly define the scope of services to obtain the most accurate and comprehensive price.

6.2.1 The preliminary site visit may or may not affect the price of the survey. Depending upon the contractual arrangement and the company providing the proposal, the time and expense of the preliminary site visit may be absorbed into the cost of doing the survey or provided without charge.

6.2.2 *Document Review*—The review of construction documents including specifications, blueprints and possibly product receipts provide information regarding asbestos-containing products, locations, and quantities. This review is typically performed after the survey contract is awarded; however, a preliminary review of these documents may be helpful in determining the number of samples necessary. The extent and ultimate cost of the review will be dependent upon the scope of the survey, the size of the facility being inspected, organization/accessibility of the documents, and the amount of documents to be reviewed.

6.2.3 *Survey Preparation and Mobilization*—Prior to beginning the survey a number of technical and logistical tasks are required to prepare for the survey. Time is required to gather field supplies and coordinate travel. When surveys require air travel, it may be most cost-effective to ship supplies and materials to the survey site in advance. In this case, shipping fees would apply. If materials are not shipped, additional baggage fees may apply when baggage limits are exceeded, and extra time may be needed to clear airport security.

6.2.4 *Travel*—Travel time is a factor in developing the cost of the survey. The cost may be included in the billing rate of the consultants performing the survey or may be billed at a full hourly/daily rate, or reduced hourly/daily rate.

6.2.5 *Survey Personnel*—Surveys should preferably be performed in teams of two or more individuals in order to provide a more thorough inspection and to provide an added safety for the team members. Persons involved in the survey may include a Principal or Technical Director, Project Manager, and Survey Team Members.

6.2.5.1 The Principal/Technical Director has the overall authority and responsibility for the successful completion of the survey. The Principal/Technical Director should insure that the scope and technical aspects of the survey conform to regulatory and professional standards. The Principal/Technical Director is also responsible for the fiscal aspects of the survey and should insure that the budget for the survey is appropriate. The Principal/Technical Director typically has the highest billing rate of the personnel on the survey. His involvement is necessary at the beginning of the survey to review the proposed scope of work and budget, during the survey to review technical and budgetary progress, and at the completion of the survey to review the final work product to insure it is technically sound. On large surveys, the Principal/Technical Director may want to attend the Preliminary Site Visit (see 6.1.7.1).

6.2.5.2 The Project Manager has the responsibility for the survey team and the performance of the scope of work. The Project Manager should possess the experience and knowledge to complete the survey in the given survey environment. Accordingly, the Project Manager will have the highest billing rate for those in the field performing the work. The Project Manager is utilized in all phases of the survey.

6.2.5.3 Survey Team Members work with the Project Manager on-site to complete the scope of the survey. Team Members typically, have a lesser degree of experience than the Project Manager and as such have a lower hourly/daily rate. The Team member is utilized during the field survey and may be used to prepare sections of the report.

6.2.6 *Sample Login*—Sufficient time should be allowed to perform sample login following each sampling shift to insure that all samples are accounted for and proper chain-of-custody is maintained. Shipping to the laboratory will be determined by the time schedule of the survey or by the need to identify specific asbestos, or non-asbestos-containing material (see 6.4.9).

6.2.7 *Quantifying Asbestos-containing Materials*—Asbestos-containing materials (presumed and confirmed) should be quantified as part of the comprehensive asbestos survey. It may be possible to reduce the budget of the survey by postponing the quantification process until the laboratory reports are received allowing for the quantification of only the confirmed ACMs rather than all suspect materials. However, it may be most cost effective to develop quantities of limited homogeneous areas or when limited numbers of suspect ACMs are sampled, rather than returning to the survey site a second time. The Project Manager should determine the most cost-effective method of quantification of ACMs based on the specifics of the survey.

6.2.8 *Assessing Asbestos-containing Materials*—Physical and hazard assessments should be performed for asbestos-containing materials (presumed and confirmed) as part of the comprehensive asbestos survey. It may be possible to reduce the budget of the survey by performing these assessments after the laboratory reports are received so that only the confirmed ACMs are assessed rather than all suspect materials. However, it may be more cost effective to perform these assessments at the time of the survey when limited functional spaces, homogeneous areas or numbers of suspect ACMs are identified. The Project Manager should determine the most cost-effective method of assessment of ACMs based on the specifics of the survey.

6.2.9 *Data Review and Interpretation*—It is important to provide sufficient time to review the survey laboratory data and interpret the results. Time is needed to determine if appropriate homogenous areas have been identified and to identify the need for follow up analyses such as PLM point count or confirmatory TEM.

6.2.10 Report preparation is performed by the Project Manager and the Survey Team members. Other individuals that may be utilized during report preparation include a draftsman/computer aided drafting designer and clerical staff. Completed reports should always be reviewed by a Principal/Technical Director or the Project Manager to insure compliance with the scope of work, standards of the industry, and technical competence.

6.2.11 *Laboratory Fees*—Laboratory fees will vary depending upon the location of the laboratory, the workload of the laboratory, the number of samples being submitted, the type of analyses requested, and the turn-around time for the results. Complete budgets for comprehensive surveys should include all analyses required for the completion of the survey. PLM analyses for a comprehensive building survey will include visual estimation at a minimum, and may include point count analyses. Quality control for PLM visual estimation will include sending duplicate samples to a second accredited laboratory.

6.2.11.1 *PCM Air Sample Analyses*—Personal air samples are required to comply with the OSHA asbestos in construction standard (29 CFR 1926.1101) for individuals who take bulk samples (see 8.2). Collection of area air samples may also be requested by the building owner. Collection of air samples is outside the scope of this Standard Practice.

6.2.11.2 *TEM Bulk Sample Analyses*—TEM analyses of bulk samples may be necessary for surveys located in specific cities or states. Additionally, TEM analyses is commonly used to verify a reported no asbestos detected result for non-friable materials by PLM.

6.2.12 *Travel/Subsistence Expenses*:

6.2.12.1 Survey budgets should identify appropriate travel costs. The cost to travel between locations will depend upon many factors, the main issues being the type of travel, the amount of travel time required and the billing rates of the individuals, and the distance traveled.

6.2.12.2 *Subsistence*—Subsistence is typically provided through a daily per diem for those traveling, which may or may not include lodging costs. The government rate of per diem for each city in the country is useful for planning purposes.

6.2.13 *Miscellaneous Expenses*—Additional factors contributing to the cost of a comprehensive survey include:

6.2.13.1 *Ladders, Lifts, Scaffolds*—It may be necessary to rent such equipment or to hire contractors with specialized equipment or expertise to access elevated materials or areas.

6.2.13.2 *Electricians*—It may be necessary to contract an electrician to de-energize systems prior to sampling, subject to the approval of the building owner.

6.2.13.3 *Abatement Contractors*—Abatement contractors may be utilized to assist with the construction of mini-enclosures to control fibers during sampling. Additionally, contractors may be hired to assist with abatement/removal budgets.

6.2.14 *Survey and Reporting Expenses*:

6.2.14.1 *Shipping*—It may be necessary to ship equipment and supplies to and from the survey site. The budget should also include sufficient resources to ship samples to the laboratory.

6.2.14.2 *Copying*—The survey budget should provide resources for copying the appropriate number of reports. The building owner may request the use of color in drawings and photographs, in which case it would be necessary to include appropriate reproduction charges.

6.2.14.3 *Film and Photograph Processing*, including preparation of digital files for a report in electronic format.

6.2.14.4 *Sampling Equipment and Supplies*, per X1.1.

6.3 *Obtaining and reviewing information*:

6.3.1 *Building or Facility Information*—Floor plans and drawings, records of construction, renovation and maintenance, and lists of equipment and furnishings should be reviewed when readily available for information that may indicate the existence of suspect ACM in functional spaces.

6.3.2 Records of asbestos activities, including previous surveys and occasional bulk sampling, should be reviewed. If samples taken during a previous survey confirmed the presence of more than one percent asbestos in a material, there is no need to re-sample that material during the present Baseline Survey, providing a sufficient number of samples were taken. For a material where samples taken during a previous survey reported less than one percent asbestos for the samples collected for the homogeneous area, the accredited inspector should determine whether there is a need to re-sample that material during the present Baseline Survey. The decision should take into account whether a sufficient number of samples were previously taken and if analytical methods were adequate.

6.3.3 Records of abatement and O&M work should be reviewed briefly for an indication of where ACM may have been removed or repaired. However, statements by the building owner regarding the absence of ACM due to previous abatement should be viewed with skepticism in the absence of suitable documentation and not used as the sole reason to dispense with inspecting any functional spaces.

6.4 *Conducting Field Work*:

6.4.1 *Mobilizing Equipment and Supplies*—See Appendix X1 for a detailed list of equipment needed for a sampling inspection. Respirators and other personal protective equipment needed are discussed in Section 8, and standard forms on which to gather information are presented in Appendix X3. The needs will be determined by the Preliminary Site Visit discussed in 6.1.7.1.

6.4.2 *Identifying and Inspecting Functional Spaces*—Functional spaces are identified for the purpose of locating homogeneous areas of suspect ACM and non-ACM, and the subsequent management of the ACM in a building. All functional spaces must be identified and located, with occupancy and use data if possible. Functional space identification should be by normal use label, or by blueprint identification. The labeling system used should be one familiar to building management.

6.4.3 *Identifying Suspect ACM*—It is important that suspect materials be classified as Surfacing Material, Thermal System Insulation (TSI) or Miscellaneous Material as determined by direct application of the definitions in 3.2, as EPA and OSHA compliance depend on these classifications. Any other regulatory determination that may vary these classifications may be applied in addition to the referenced definition as a specific case may require.

6.4.3.1 Most building materials shall be considered suspect ACM and any person may assume that a suspect material contains asbestos. However, EPA and OSHA regulations permit only an accredited inspector to determine that thermal system insulation is fiberglass, foam glass, rubber, or other non-ACM without bulk sampling. The inspector must use his judgment in excluding apparently obvious non-asbestos materials such as glass, steel, concrete, porcelain and wood from sampling. The complete identification and location of all suspect materials in a building is basic and essential to a comprehensive building asbestos survey, and if in doubt as to possible asbestos content, the inspector should sample the material.

6.4.3.2 Record the date, manner of sampling, sample identification number, exact sample location, and sampling inspector identification and certification. The location of each bulk sample shall be recorded on a sample log and a schematic drawing of the building or space of the building from which the sample was collected if available. The sample location description should provide sufficient detail that a person unfamiliar with the building could locate the exact sample location without undue difficulty.

6.4.3.3 The suspect material must also be described in a useful and functional way, such as: floor tile, fireproofing, or pipe insulation. Avoid the use of in-house, company or construction industry acronyms in the report documents. Use material descriptions that will be meaningful to a person who may not be familiar with construction terminology.

6.4.4 *Quantifying Suspect ACM*—All suspect ACM must be quantified for bulk sampling procedures and for regulatory applicability and compliance purposes under the various federal regulations. Since the NESHAP regulation specifies a quantification standard applicable to renovation and demolition and annual O&M reporting, all suspect ACM shall be quantified according to that standard. This will facilitate preparing an annual O&M notification as well as laying the foundation for a possible Project Design Survey in event of an abatement project.

6.4.4.1 Pipe insulation must be quantified in linear feet (meters), and a notation made if fittings are included or quantified separately.

6.4.4.2 Other thermal system insulation, miscellaneous material, surfacing material and all other suspect material on facility components must be quantified in square feet (square meters).

6.4.4.3 Bulk waste or material not installed on facility components must be quantified in cubic feet (cubic meters).

6.4.5 *Identifying Homogeneous Areas and Sampling Locations*—All suspect ACM must be identified by homogeneous area of material. A homogeneous area is an area of material that is the same in color, texture, date of application and general appearance, wherever it may appear in the building. It must either be assumed to be ACM and managed as such, or sampled and proven to be ACM or non-ACM. The homogeneous area is the basis of identification of suspect ACM. To aid in determining homogeneous areas the color, texture, and appearance of the suspect materials should be described for all layers of the material when viewed from different vantage points. For example, when describing a suspect ceiling tile, the inspector should provide a description of the exposed surface when viewed from below, the composition of the interior of the ceiling tile and the concealed (top) portion of the ceiling tile. An appropriate description in this example could be: white 2 by 4 ft ceiling tile with small gouges and small holes producing a flower pattern on the exposed surface of the ceiling tile visible from beneath. The interior of the ceiling tile is tan with visible fibrous material. The top of the tile is red in color.

6.4.5.1 *Sample Locations*—Where feasible, the manner used to determine sample locations for any suspect material within a homogeneous area shall be the random sampling manner described in the EPA "Pink Book."

6.4.5.2 Without compromising safety, disturbing occupants or aesthetically damaging surfaces, use random sample locations for materials that may have been batch-mixed at the site. Such materials, which may vary in asbestos content throughout a homogeneous area, include fireproofing, ceiling and wall texture, acoustical plaster, hard plaster and pipe fitting insulation.

NOTE 5—The "Pink Book" describes a random sampling scheme for flat surfaces such as ceilings. For large cylindrical objects such as tanks and vessels, an equivalent "flat" surface is an area defined by the height or length of the object and its circumference. For homogeneous areas that are one-dimensional (linear), such as pipe insulation and fireproofed beams and columns, use a random number table to select sampling locations along the length of the item.

6.4.5.3 Random sample locations are less important for homogeneous areas where the asbestos content is expected to be relatively uniform due to product specifications. Such materials include floor tile and mastic, ceiling tiles, straight runs of pipe insulation and asbestos-cement products. Sheet vinyl flooring should be sampled randomly due to the uneven absorption of adhesive by the backing.

6.4.6 *Collecting Bulk Samples*, (also see Appendix X1). Bulk sample collection and analysis is used to determine the asbestos content of suspect materials identified during a survey. Sampling and analyses also distinguishes between suspect materials that appear identical in the field but may actually be different products. The proper homogeneous determination is of utmost importance to the person developing asbestos O&M programs and designing removal projects and other response actions. A sufficient number of bulk samples should be collected of suspect materials throughout a facility to thoroughly characterize the asbestos content. The samples should be spaced throughout the facility in such a manner to adequately cover all elevations, wings, additions, and renovations.

6.4.6.1 *Number of Samples to be Collected*—This standard practice encourages the collection of samples beyond the minimum numbers recommended below to ensure that homogeneous areas are defined as accurately as practical.

6.4.6.2 A minimum of three bulk samples representative of each distinct homogeneous area of suspect thermal system insulation material (TSI) should be collected. One sample should be collected of each TSI patch. For the purpose of this standard, a patch is a distinct location or replacement or repair which is less than or equal to 6.0 ft (1.82 m) or 6.0 ft^2 ($0.557 m^2$).

6.4.6.3 A minimum of three bulk samples shall be collected of each homogeneous miscellaneous material, except that a single sample may suffice for small manufactured items such as HVAC vibration dampeners, gaskets and friction products.

6.4.6.4 A minimum of three bulk samples shall be collected of surfacing materials of less than 1000 ft^2 (93 m^2). A minimum of five bulk samples shall be collected of homogeneous surfacing materials ranging between 1000 to 5000 ft^2 (93 to 465 m^2) and a minimum of seven bulk samples shall be collected of surfacing material >5000 ft^2 (465 m^2). The inspector should attempt to collect samples of surfacing from each wing, floor and/or level of large facilities.

6.4.6.5 Collection methods and equipment are provided in Appendix X1 for a wide range of suspect materials. For many materials, disposable coring devices are the most practical means of talking a bulk sample. Maintaining the integrity of layered samples, sample containers for friable and non-friable materials, labeling of sample containers, sample packaging and sample labeling are discussed in detail in Appendix X1.

6.4.7 *Identifying Presumed/Assumed ACM*—When conducting a baseline survey for asbestos management and planning in a building that will remain occupied, it may be more appropriate to assume that some suspect materials are ACM, rather than sample to prove that they are not. When this is done, these materials must be listed in the report as "Assumed ACM" rather than "ACM." This means that they have never been sampled, but must be treated as ACM. In most cases, they would then be sampled later in a Project Design Survey (see Section 7). It may be more appropriate to assume rather than sample when maintaining the integrity of a fire rated assembly, maintaining an undamaged aesthetic appearance, complying with restrictions on sampling for safety reasons, or if access is not provided to a functional space or a concealed space. An example of such an assumption for a concealed space would be an inaccessible chase where the insulation on the pipes in the chase resembles that on the pipes to which they connect in the plenum and the insulation of the pipes in the plenum is confirmed, assumed or presumed to be ACM." Regulatory requirements on presuming (OSHA) or assuming (EPA) materials to contain asbestos must be followed.

6.4.8 *Documentation of Field Work*—See Appendix X3 for sample forms with which to document field work.

6.4.9 *Sample Processing*—After the samples are collected, they must be processed for shipment to the laboratory.

6.4.9.1 *Chain of Custody*—The control and custody of the bulk samples from collection to submission to an accredited laboratory should be documented with a chain-of-custody document. The bulk sample numbers for each sample set should be entered on the chain of custody. The action taken on the sample at the time when the custody of the samples change should be documented and attested to by the signature by those participating in the custody change. This standard practice understands that shipping of bulk samples to laboratories is common practice. Prior to shipping the samples should be properly labeled and sealed to prevent tampering or inadvertent opening by those other than the intended recipient. It is not necessary for the courier to sign the original chain of custody as their handling of the samples is documented with the routing paper work provided through billing. When samples are shipped, it is the recipients' responsibility to inspect the sample packaging to ensure that tampering has not taken place. A signature of receipt signifies that the package was inspected and the samples had not been damaged or tampered during shipping.

6.4.9.2 Quality control samples, split samples and archived samples should be prepared during sample processing and sent to the proper laboratories for analysis or stored in a secure location under the control of the accredited inspector.

6.5 *Bulk Sample Analysis*—Analysis of the bulk samples must consider the type(s) of analysis to be performed and whether it is necessary to analyze all of the samples collected. Reporting of laboratory results is an integral part of the analytical effort.

6.5.1 *Analytical Methods*—For most materials, PLM is adequate to establish the presence of asbestos in materials and to quantify it to a reasonable degree of precision by the technique known as visual estimation. PLM and visual estimation of asbestos content may be relied on to establish the presence of asbestos in amounts greater than one percent for any material, which means it must be treated as asbestos-containing. Additionally, analyses by PLM with visual estimation may be relied upon to conclude that friable suspect materials do not contain asbestos with a result of "no asbestos detected." In the event the laboratory reports a result of trace, less than one percent or one percent, additional analyses is necessary as discussed below.

6.5.2 PLM with visual estimation of asbestos content may not be relied on for establishing the amount of asbestos in a material as being equal to or less than one percent, which would exclude it from consideration as asbestos-containing. To do this, analytical procedures such as point-counting, gravimetric methods, Transmission Electron Microscopy, or the "Chatfield method" must be used. These procedures are required to confirm that asbestos is not present above one percent in materials sometimes referred to as "Non-friable Organically Bound" or "NOB" materials. The most common application of this requirement is vinyl asbestos floor tile, but these procedures should be considered for any material where small fiber size and the presence of interfering substances render Polarized Light Microscopy unreliable for definitive confirmation of asbestos content below one percent. It is common for laboratories to include a disclaimer to this effect on the sample results.

NOTE 6—Although not considered an "NOB" material, loose fill insulation containing vermiculite presents difficulties in the detection of amphibole asbestos using conventional PLM techniques. This standard practice recommends that loose fill insulation be analyzed for the presence of vermiculite and, if it is found, that the presence of asbestos contamination be assumed regardless of whether asbestos in any form and at any concentration is identified. The survey report should include appropriate precautions against exposure to asbestos fibers that may be present in vermiculite loose fill insulation. Archive samples of the insulation should be retained for analysis at such future time when more definitive and accurate analytical methods become available.

6.5.3 *Protocol for Confirmation of Results*—Protocols exist for the number of samples required to be analyzed for the confirmation of positive (>1 % asbestos) and negative (≤1 % asbestos, including "NAD") results. One positive sample from a homogeneous area can be considered evidence that all suspect material in that homogeneous area contains asbestos without analyzing he remaining samples. This is sometimes referred to as the "positive stop" approach. Factors to consider in deciding whether to use this approach include the following:

6.5.3.1 *The Inherent Homogeneity of the Material*—Straight runs of pipe insulation, ceiling tiles, pipes, ducts and panels of siding, for example, were manufactured to specifications that included the amount of asbestos in the product. Therefore, if one sample from such a material contained asbestos, the remaining samples from similar-appearing materials could reasonably be expected to do so as well. On the other hand, batch-mixed materials such as fireproofing, ceiling and wall texture, acoustical plaster, hard plaster and pipe fitting insulation ("mudded joints") are more likely to vary in their asbestos content. This will not be apparent to the inspector who is taking the samples, and is due to adding the asbestos fiber at the job site or mixing asbestos-containing products with other materials, thereby diluting the asbestos content. For this reason, a single positive sample may not be indicative of the overall homogeneous area and all samples should be analyzed to determine if more than one homogeneous area actually exists, including some where no asbestos is present.

6.5.3.2 *The Relative Uncertainty of Analytical Results*—If a sample contains more than ten percent asbestos, it is highly unlikely that another sample from the same homogeneous area will have ≤1 % asbestos, or no asbestos at all. As the reported asbestos content approaches 1 %, the variability of the reported asbestos content increases to the point where confirmation by analyzing more samples is advisable.

6.5.3.3 *The Uncertainty of Identifying Homogeneous Areas*—Identification of homogeneous areas is a matter of judgment, and using "positive stop" could result in treating material as asbestos-containing because it was incorrectly included in a homogeneous area from which only one sample was positive. If there is any doubt as to the homogeneity of a sampling area, all samples from that area should be analyzed. For example, fireproofing in a facility may appear identical in color and texture (tan high density); however, it is possible that the fireproofing may be two distinct materials, one with intentionally added asbestos and the other a non-asbestos containing replacement product. In this example, the inspector would identify the two distinct homogeneous materials (products) as one homogeneous area and could cause unnecessary expense to the facility owner by removing or performing other response actions on non-ACM materials. Complete and proper sampling of these materials should be performed to identify inconsistencies within designated homogeneous areas.

6.5.3.4 *The Ultimate Value of the Information*—For purposes of managing asbestos, the elimination of functional spaces from consideration reduces the number of employees and contractors affected. The resultant cost saving and other intangible benefits can easily outweigh the additional analysis and documentation costs. If a decision is made to abate the ACM, reducing the quantities reported on the NESHAP notification will, in some jurisdictions, reduce the notification fees. Of course, other abatement costs will also be reduced.

6.5.4 *Reporting Analytical Results*—To confirm the absence of asbestos in amounts greater than one percent, the minimum number of negative (≤1 % or "NAD") samples required is set by various regulatory requirements.

6.5.4.1 The NESHAP regulation requires that visual estimation of asbestos content reported as ≤1 % or trace quantities be confirmed by "point-counting" to exclude a material from treatment as ACM. Confirmation by gravimetric methods or the "Chatfield method" for NOB and other materials is also acceptable. A result of "NAD" for "No Asbestos Detected" means that no asbestos fibers were identified on three replicate slide mounts from the same sample under Polarized Light Microscopy. Point-count analyses are not required for samples reported as having no asbestos detected.

6.5.4.2 Given the acceptability of the analytical procedure, regulations require that a minimum number of samples be analyzed as negative for asbestos. The most familiar of these requirements are found in the AHERA regulations at 40 CFR Part 763, §763.86, which are also referenced for surfacing material and thermal system insulation in the OSHA construction standard at 29 CFR 1926.1101(k)(5). The number of samples required to exclude a material from treatment as asbestos-containing depends on the type of material and, for surfacing material, the area. Compliance with these requirements may dictate analysis of all samples collected per 6.4.6.1-6.4.6.4 to verify the absence of asbestos at the regulated level.

6.5.4.3 The laboratory results should be very clear on what is meant by "trace" and "NAD" if these terms are used. The accepted definition of "NAD" is given in 6.5.4.1. "Trace" usually means that at least one asbestos fiber was identified in the sample but the amount was estimated at one percent or less. However, the use of this term varies among laboratories and the specific meaning assigned to the analytical results should be requested. In no case should a "Trace" result based on PLM with visual estimation be used to exclude material from treatment as asbestos-containing without confirmation by point-counting, gravimetric or TEM analysis.

6.6 *Assessment of ACM*—For purposes of deciding whether to abate ACM or continue managing it in place, and to select the appropriate response actions, the ACM must be assessed according to one of the protocols in Appendix X2. Particularly when a large number of functional spaces and homogeneous areas are included in the survey, assessments are a valuable tool in setting priorities for response actions. Assessments complement, but do not replace, experience and common sense when determining priorities for response actions.

6.6.1 Qualitative assessments include the "AHERA" categories (undamaged, damaged, significant damaged, potential for damage, potential for significant damage, and remaining undamaged ACBM with low potential for damage) and other classification systems (good/fair/poor, accessible, etc.), hazard ranking, response action priorities and recommendations (abatement, O&M) for controlling the asbestos hazard.

6.6.2 Quantitative assessments are based on numerical ratings for Current Condition and Potential for Disturbance. Tabulation of assessment ratings and preparation of Abatement versus O&M decision charts are used to develop recommendations for response actions.

6.7 *Preparing a Report*—The Baseline Survey report is developed from the information collected during the field work, the laboratory results and the assessment. Using forms compatible with the survey report requirements, including electronic formats and file structures, for data collection and manipulation facilitates this process.

6.7.1 Appendix X3 contains a set of forms that can be used as templates for collecting and manipulating the survey information, as well as compiling it in the form of the survey report. In addition to the forms in this appendix, drawings must be prepared (or marked up) showing the functional spaces inspected, locations of samples taken and the locations of confirmed or presumed ACM.

6.7.2 Copies of field data sheets filled in during the inspection, copies of laboratory results and copies of inspector and laboratory credentials should be included as appendices to the hardcopy version of the survey report, or scanned for inclusion in an electronic copy. Unless the building owner has specified the use of color in the survey documentation, homogeneous areas and functional spaces should be identified in black and white on the survey drawings to facilitate copying survey reports without a loss of information in the reproduction process.

6.7.3 Before submitting the survey report to the building owner, it should be reviewed by the Survey Team Members who conducted the field work and by the person who performed the assessments. If applicable, it should also be reviewed by the Project Manager and Principal/Technical Director (see 6.2.5).

7. Project Design Surveys

7.1 The Project Design Survey differs from the Baseline Survey in that it is limited to the functional space(s) in the building or facility that are going to be affected by an abatement project. Besides this limitation, other factors define the scope and conduct of a Project Design Survey.

7.1.1 OSHA regulations require that certain persons and agencies be notified of the presence of ACM whenever abatement takes place. For renovation and demolition, the NESHAP regulation requires verification that asbestos-containing materials were looked for and, if any are found, the categories and quantities must be reported. The AHERA regulations require that a project design be prepared for abatement of friable ACM in schools. Some local agencies require that an asbestos survey be conducted as a condition of issuing a building permit for renovation.

7.1.2 If a Baseline Survey has provided sufficient information on ACM in an area to be impacted by an abatement project, the information from that survey will satisfy the regulatory notification requirements without conducting additional survey activities. However, a Project Design Survey is still needed for other purposes as described herein.

7.1.3 As the main purpose of the Project Design Survey is to provide information for preparing abatement plans and specifications, the person who conducts the survey should be accredited as a Project Designer. If he signs the contract documents, accreditation is mandatory.

NOTE 7—ACM is frequently removed without the preparation of plans and specifications, particularly from industrial facilities. Unless the abatement contractor or an in-house staff member is accredited as a Project Designer, it is prudent to avoid using the term "project design" or similar terminology when documenting the work. While the concepts and approaches in this section may still be useful in such cases, reference to this standard in project documents is discouraged to avoid the appearance of a project design being prepared by an unqualified person. The best course of action is to have the plans and specifications prepared by an accredited Project Designer.

7.1.4 Presumption or assumption of asbestos content is not permitted for a Project Design Survey. All suspect materials are sampled and analyzed so that materials which were not determined to be asbestos-containing may be left in place.

7.1.5 Unless decisions still remain to be made as to whether to remove ACM or leave it in place, assessments as described in Appendix X2 are not performed for a Project Design Survey.

7.2 *Perform the Planning Activities Necessary for the Survey*:

7.2.1 If a Baseline Survey has been conducted, review the portions of the survey report pertaining to the functional space(s) that may be affected by the abatement project. The scope of the project may be determined by renovation or demolition, in which case the plans and specifications prepared by the architect or engineer should be consulted, regardless of whether or not a Baseline Survey has been performed.

NOTE 8—If the abatement project will precede a renovation or partial demolition, consult the architectural or engineering drawings to determine the "limits of construction." The Project Design Survey should include all spaces within these limits, as well as adjacent areas where ACM may be disturbed by construction activities. ACM within this expanded area must also be abated, and the survey must define these "limits of abatement." It may be necessary, for example, to abate ACM on floors above and below the floor on which renovation is taking place, or in an adjacent attic or crawl space.

7.2.2 Decide who conducts the survey—a consultant or in-house staff—and select the analytical laboratory to be used. Whoever conducts the survey must be qualified according to Section 5 and the laboratory must be qualified to perform the type of bulk sample analysis required.

7.2.3 Establish the scope of the survey to include the buildings and facilities or portions thereof impacted by the abatement requirements.

7.2.4 Determine the required number of bulk samples by type and location of suspect ACM that may be present in the areas affected by the abatement. It may not be necessary to sample some materials if the contemplated abatement will not disturb them. However the design team may make the determination that it may be beneficial, from a cost standpoint, to include these materials in the abatement project.

7.2.5 Determine the analytical requirements and decide whether the primary method of analysis—PLM—must be supplemented by PLM with point-counting or by TEM. Establish a protocol for results with ≤ 1 % asbestos.

7.2.6 Establish the content and format of the report (narrative, tables, drawings and attachments such as the laboratory report) to document the results of the survey. This will include, but not be limited to, information that the Project Designer will use in preparing the abatement plans and specifications. The survey report, for example, will contain the survey methodology and complete laboratory results, information that the Project designer may decide not to include in the contract documents for the abatement project. Establish submittal dates and a review process for the report before it is submitted.

7.2.7 Establish a schedule with the building owner for a preliminary site visit, if necessary, and the dates on which you will start and complete the field work. Arrange to meet with the architect or engineer who is designing the renovation, if applicable, to get a copy of the renovation plans as soon as they are available. Determine the available times of access for the areas to be included in the survey, and find out if the premises will be occupied at the time of your visit. Find out if lights and power will be available in the building when you arrive to do the survey.

7.2.8 The estimated cost of survey will include labor charges for field work, office support and management oversight. Laboratory charges will depend on the number of samples and type of analyses requested and the turn-around time if expedited results are needed. Other expenses include travel and subsistence for out-of-town surveys, rental of equipment such as man-lifts and photographic documentation. For a detailed discussion of survey costs, see 6.2.

7.3 *Conducting the Field Work*—Information regarding ACM and other aspects of project design will be collected during one or more visits to the building or facility.

7.3.1 Mobilizing equipment and supplies is an important prelude to conducting field work efficiently. Sampling equipment, bulk sample containers, lights, tools, ladders, PPE and other items should be assembled for ready access. See Appendix X1 for a list of equipment and supplies.

7.3.2 Conducting the field work may include destructive testing if access to concealed spaces is needed. These spaces may contain suspect ACM or it may be necessary to confirm that none are present therein. If destructive testing must be done in occupied spaces, it may be necessary to temporarily patch the opening in the wall or ceiling. Penetrating building surfaces may create dust that is harmful to equipment or objectionable to occupants, and measures to control the dust must be taken during the survey. It may be necessary to perform a preliminary survey of a building system or component prior to performing destructive sampling to determine if the surface being breached contains asbestos. For example, an inspector may need to collect bulk samples of plaster prior to creating a hole in a ceiling to prevent the spread of asbestos fibers, dust and debris in the space during the destructive testing.

7.3.3 Locate and inspect the functional space(s) that will be impacted by the abatement project. Any functional spaces that cannot be inspected due to restricted accessibility or other reasons must be documented. Identify suspect ACM according to the type of material (surfacing material, thermal system insulation or miscellaneous material) and its description (pipe insulation, fireproofing, floor tile, etc.) If no suspect ACM is present in a functional space, or if the only materials present are those which an accredited inspector can determine without sampling do not contain asbestos, document this information.

7.3.4 Identify the homogeneous areas within each functional space, and those that overlap adjacent functional spaces, by similarities in the type of material, its appearance, color, texture and probable date of installation. For each homogeneous area, determine the number of samples to be taken from random and non-random locations, consistent with 6.4.6.1-6.4.6.4 and the following provisions:

7.3.4.1 Where feasible, the manner used to determine sample locations for any suspect material within a homogeneous area shall be the random sampling manner as described in the EPA "Pink Book."

7.3.4.2 Without compromising safety or disturbing occupants, use random sample locations for materials that may have been batch-mixed at the site. Such materials, which may vary in asbestos content throughout a homogeneous area, include fireproofing, ceiling and wall texture, acoustical plaster, hard plaster and pipe fitting insulation.

NOTE 9—The "Pink Book" describes a random sampling scheme for flat surfaces such as ceilings. For large cylindrical objects such as tanks and vessels, an equivalent "flat" surface is an area defined by the height or length of the object and its circumference. For homogeneous areas that are one-dimensional (linear), such as pipe insulation and fireproofed beams and columns, use a random number table to select sampling locations along the length of the item.

7.3.4.3 Random sample locations are less important for homogeneous areas where the asbestos content is expected to be relatively uniform due to product specifications. Such materials include floor tile and mastic, ceiling tiles, straight runs of pipe insulation and asbestos-cement products. Sheet vinyl flooring should be sampled randomly due to the uneven absorption of adhesive by the backing.

7.3.4.4 If samples taken during the Baseline Survey confirmed the presence of more than one percent asbestos in a material, there is no need to re-sample that material during the Project Design Survey, providing the proper number of samples were taken and the inspector and Project Designer concur as to the homogeneous area designation of the material. For a material where samples taken during the Baseline Survey were reported to have no more than one percent asbestos, the accredited inspector should determine whether there is a need to re-sample that material during the Project Design Survey, taking into account whether an sufficient number of samples were taken and if analytical methods were adequate.

7.3.4.5 For OSHA notification purposes, the number of samples taken should be sufficient to rebut the presumption of asbestos-containing material (PACM) as specified in 29 CFR 1926.1101(k)(5), which references the AHERA regulations in §763.86. Inspection for NESHAP notification purposes does not have any sampling requirements in 40 CFR Part 61.145, but as the inspection constitutes a rebuttal of the presumption of asbestos content, the requirements of 29 CFR 1926.1101(k)(5) that reflect the AHERA regulations in §763.86

should be followed. Inspections for building permit applications should follow any applicable requirements of the permitting authority. Otherwise, revert to the OSHA requirements or any state or local rules that apply.

7.3.5 Material quantities may be determined at the same time that bulk samples are collected, in which case all suspect ACM must be quantified. If quantities are determined on a subsequent visit after the sample results are known, only confirmed ACM need to be quantified.

7.3.5.1 The type of material and description determine the units of measure. Square feet (square meters) is used for surfacing material, floor tile, tank and duct insulation and other materials for which area is the most logical unit. This might include fireproofing on structural members where calculation of surface area is overly complex. The thickness of these materials should be measured in order to estimate disposal quantities. Linear feet (meters) is the measure used for straight runs of pipe insulation, for window caulking, asbestos-cement pipe and ducts, and other materials where length is more descriptive of the quantities. For pipe fittings, either count the number of insulated valves, tees, elbows, etc. or indicate that they are included in the linear feet (meters) of pipe insulation, being sure to count fittings separately if the straight runs of insulation are not asbestos-containing material.

7.3.5.2 Quantities are required for OSHA and NESHAP notification purposes, and in some cases for a building permit application. The notification fees levied against the building owner may depend on the quantities of ACM reported on the NESHAP notification. In addition, OSHA requires that the percent of asbestos present in the material be provided (and, by implication, the type). Where the sample results show varying percentages of asbestos, indicate the range for OSHA notification.

7.3.5.3 Estimation of quantities of ACM to be removed is very important for project design purposes. The Project Designer must include this information in the plans and specifications in sufficient detail to give the prospective bidders a reasonable indication of the scope of work. While the bidders are responsible for their own estimates, gross discrepancies between the design documents and the bidders' estimates may indicate that ACM was over-looked or incorrectly quantified during the Project Design Survey. Such situations obviously must be rectified before the abatement contract is awarded.

7.3.6 Collect the bulk samples using methods and equipment discussed in Appendix X1, being careful to maintain the integrity of layered samples where necessary. In addition to sampling accessible materials, perform necessary destructive testing to inspect concealed spaces and sample suspect materials therein. Access to concealed spaces that might be impacted by the abatement project should not be precluded by physical or institutional reasons (such as refusal of permission to enter). Since the material is going to be removed during abatement or subsequent renovation, aesthetic considerations and damage to building surfaces is not of concern during a Project Design Survey.

7.3.6.1 Crawl spaces must be carefully inspected if abatement of installed ACM, dust and debris or contaminated soil is intended. Pipes, ducts and fireproofed surfaces must be sampled and quantified as in an occupied part of the building. If dust and debris are present on the surface of the dirt, is mixed in with loose dirt or is impacted into the sub-base (defined in 3.2), the inspector must determine over what area of the crawl space, and to what depth, such contamination extends. Trenches under pipe runs may have been filled with dirt containing the remains of insulation that had been removed during a previous renovation. If moisture is present, water may have soaked into soft dirt, along with asbestos dust and debris. Samples of dust and debris should be separated from the dirt in which they are mixed so they can be analyzed for their own asbestos content, not as a composite of a soil mixture. Respirators and protective clothing should be worn when inspecting a suspected contaminated crawl space, due to the high fiber levels that can result from stirring up dry contaminated soil. It may be necessary to treat the crawl space as a confined space (see Section 8).

7.3.6.2 If several floors of a multi-story building are to be abated, care must be taken not to incorrectly attribute quantities and characteristics of ACM observed on one floor to another floor. While some repetition is to be expected, each floor is its own set of functional spaces and may have different mechanical, structural and architectural requirements from those above and below it. Stairwells, pipe and duct chases, elevator and cable shafts, and air shafts are separate and distinct functional spaces from the floors they traverse. These spaces should be inspected with the expectation that the project design will treat them individually for abatement purposes.

7.3.7 Processing of collected samples before sending them to the laboratory may include dividing the samples for quality control and splits, retention of archive samples or sample examination prior to shipment. Handling samples in this manner means opening the containers, which must be done in a HEPA-filtered ventilation hood for friable materials. A properly-executed chain of custody must accompany the shipment of samples to the laboratory, along with instructions as to the type of analysis requested and expedited turn-around if needed (see 6.4.9.1). The inspector should retain a copy of the chain-of-custody and the original chain-of-custody should remain with the samples.

7.3.8 Documentation of field work includes: the sample data sheets for bulk samples taken, a record of inspection of all functional spaces, including those where no samples were taken, floor plans or drawings showing sample locations, functional spaces and homogeneous areas, and photographs of representative or significant inspection and sampling locations. This information will be used to prepare the survey report as well as the plans and specifications.

7.3.9 In addition to taking bulk samples and quantifying ACM, the Project Design Survey affords the opportunity to obtain other information essential to project design. Many of the following items require consultation with the building owner or the design professional responsible for the renovation, and their representatives should be available during the Project Design Survey. The extent to which some of the following items need to be investigated also depends on whether a "means and methods" approach to project design is contemplated, or if the Project Designer intends to leave the details of execution to the abatement contractor.

7.3.9.1 *Phased Abatement*—Renovation is often performed in phases, with one area vacated and renovated, then re-occupied while another area is vacated and renovated. The areas for phased renovation may be contiguous or separated. Abatement project design must consider the renovation sequence and schedule and be phased accordingly. In addition to consulting the renovation plans, the Project Designer must visit the site to identify the limits of construction for each phase of the renovation, so that the limits of abatement and the abatement schedule can be set accordingly.

7.3.9.2 *Emergency Egress*—Provisions for egress from the enclosure in event of fire or other emergency must be anticipated by the project designer. If abatement is to be done in an occupied building, emergency egress routes for occupants must be preserved in accordance with local codes and facility safety requirements. Access routes for emergency services such as fire and rescue must be located so that they remain unimpeded by the abatement preparations.

7.3.9.3 *Essential Facility Services*—Power must remain on outside the regulated area, and the Project Designer must locate the panels to determine if access to them will be restricted by abatement activities. He must also locate controls for fire alarms, security and telecommunications to ensure that they can remain operable if within the regulated area, or if they must be temporarily relocated by facility staff. Special provisions may be needed for access to this equipment during the project, including uncontaminated enclosures or entry into the regulated area by properly trained and equipped maintenance staff for limited periods of time. In some buildings and facilities, gas and liquid services such as sprinkler systems, oxygen lines in a hospital and process piping in a factory must remain in operation and be protected from damage or contamination.

7.3.9.4 *HVAC*—HVAC systems serving the spaces to be abated must be identified so they can be turned off during site preparation and abatement. If abatement is to be done in an occupied building, provisions must be made to maintain ventilation in adjacent areas not undergoing abatement, including above and below.

7.3.9.5 *Contractor Mobilization*—Space must be identified where the contractor can store his equipment and supplies outside the regulated area (enclosure, decontamination unit, and load-out). It must be possible to secure this space against unauthorized entry while the contractor and project monitor are not on site.

7.3.9.6 *Restricted Areas*—Parts of the building or facility that will be off-limits to the contractor's workers, or limited to access by the supervisor, must be identified during the Project Design Survey. If toilet facilities in the building are not to be used by the contractor, this must be determined during the Project Design Survey.

7.3.9.7 *Hazardous Working Conditions*—The need to work at elevated locations must be evaluated during the Project Design Survey, including the height above the floor or ground of the ACM to be abated. If confined spaces must be entered for abatement, they should be identified so they can be described in the project documents. Operating machinery that must remain in use, electrical lines that cannot be de-energized, and pipes that cannot be de-pressurized or cooled down must be identified. Sources of chemical hazards that must be removed during preparation or remain in the area must also be identified.

7.3.9.8 *Water and Power*—The Project Designer should determine where the contractor will be able to obtain water for removal and decontamination, and electrical power for his equipment. One or more electrical panels should be found outside the area to be abated where leads can be brought out to the contractor's power panel(s). Power for high-volume air sampling pumps should also be located. If water and/or power cannot be provided by the building or facility owner, locations where the contractor can position a portable tank and/or generator need to be identified.

7.3.9.9 *Decontamination and Load-out*—The personnel decontamination facility and waste load-out are part of the regulated area accessible from the contractor's mobilization area, and adequate space must be provided for them. The Project Design Survey should identify possible locations inside or outside the building, including space to position a trailer-mounted decontamination unit if necessary. The availability of water and power for the decontamination unit and load-out, and a place for disposal of filtered water, must also be addressed.

7.3.9.10 *Negative Pressure Enclosures*—Satisfactory operation of a negative pressure enclosure is affected by many characteristics of the building or facility. Provisions must be made to exhaust the discharge of the HEPA-filtered ventilation units outside the building if possible, or at least into an unoccupied space where air samples can be taken regularly. The enclosure must be protected from intentional or accidental damage in areas not conducive to routine surveillance. The Project Designer should inspect the building for conditions that could compromise the integrity of the negative pressure enclosure and its ability to provide the required pressure differential. These include penetrations in the building envelope, such as broken windows, that allow air infiltration, as well as loading docks and other large openings where wind can affect air flow and pressure distributions inside the building.

7.3.9.11 *Waste Disposal*—Locations must be found where bags and drums of removed ACM and contaminated waste material may be temporarily stored while awaiting disposal. These locations may be inside the building or outside, and also include a place where waste transport containers may be positioned for the duration of the project or temporarily during loading and pick-up. Provisions must be made for securing the waste transport containers against tampering.

7.3.9.12 *Visibility Barriers*—OSHA regulations require that signs with specified wording be posted at the entrance to regulated areas. However, some building owners do not want these signs to be visible to occupants of adjacent spaces. The Project Designer should identify the locations from which the regulated area and contractor's mobilization area can be seen, so that "visibility barriers" can be constructed to shield the contractor's operations from view. (Bear in mind that workers often change clothes in the "mobilization area" outside the clean room of the decontamination unit.)

7.3.9.13 *Demolition*—There are times when even destructive testing during the Project Design Survey cannot adequately locate all of the ACM that will have to be abated. In such cases, the abatement contractor must demolish parts of walls and ceilings to expose suspect materials for additional sampling. Because this often results in additional abatement through change orders after the contract is signed, the Project Design Survey should include examination of functional spaces to determine where this situation might occur.

7.3.9.14 *Spot Removal*—The Project Designer must carefully examine the perimeter of the limits of abatement to determine if any ACM must be removed, encapsulated or enclosed to complete construction of the negative pressure enclosure. If "spot removal" of ACM must be done to provide uncontaminated work space for unprotected tradesmen such as plumbers and electricians involved in the renovation, such locations must be identified during the Project Design Survey.

7.3.9.15 *Testing Fireproofing*—If encapsulation is being considered as an abatement technique for fireproofing, the fireproofing should be tested for internal strength (cohesion) and bonding to the substrate (adhesion). The Project Designer must determine the number of places to do the tests and their locations, and prepare a test plan. The results of the tests will show whether use of a penetrating or bridging encapsulant is acceptable and, if so, provide information for the plans and specifications. Test Method E 736 and Practice E 1494 include the test methods to be used. The Project Designer should consult the fireproofing manufacturer for specifications on cohesion and adhesion performance.

7.3.9.16 *Substrates*—The characteristics of substrates to which surfacing materials are applied should be determined in order to evaluate the difficulty of removal. Rusted steel, pitted concrete, metal lath and floor leveling compound are just a few examples of substrates that should be identified during the Project Design Survey so they can be addressed in the project design.

7.3.9.17 *Asbestos-cement Materials*—If asbestos-cement products such as siding or Transite™ panels on a building, cooling tower or other structure located outdoors are to be removed, the Project Designer should determine if the surface has weathered to the extent that loose fibers are exposed, or if there is dust and debris from other causes. For siding installed near ground level, dust and debris may have contaminated the dirt near the building. Determine the locations of nearby ventilation intakes, windows or doors to establish whether a negative pressure enclosure should be constructed. It may also be advisable to construct a visibility barrier (see 7.3.9.12).

7.3.9.18 *Consultant's Field Office*—A space must be located near the abatement area, but separate from the contractor's mobilization area, where the owner's representative can establish a temporary field office. Space must be provided to store and calibrate sampling pumps, and store personal protective equipment, leaf blowers and other items used by the project monitor. The space must be sufficiently clean and removed from sources of airborne fibers to perform on-site Phase Contrast Microscopy analysis of air samples. Provisions must be made to secure this space when unattended.

7.3.10 Renovation following an abatement project often includes installation of non-asbestos materials to replace the ACM removed. Frequently, the same consultant and contractor who handle the abatement project will also do the replacement work. Even though information for the replacement work may be collected at the same time that the Project Design Survey is being conducted, this work is not considered part of the abatement project. For this reason, replacement of fireproofing, plaster, pipe and boiler insulation, floor covering and other removed ACM is not within the scope of this standard practice.

7.4 Analyzing the bulk samples by PLM and/or TEM as needed must be done according to a recognized method such as those described in EPA-600/R-93/116 (see 6.5.1).

8. Safety and Health Considerations

8.1 While conducting the field work portion of the survey, the inspector shall comply with all applicable safety and health regulations, as well as the policies of the building or facility owner or manager. Submittal and approval of a written safety plan may be required.

8.2 *Respiratory Protection*:

8.2.1 This standard practice requires that a half-mask, negative-pressure respirator be worn, as a minimum, while collecting bulk samples of suspect materials.

NOTE 10—Bulk sampling is considered Class III work by OSHA under 29 CFR 1926.1101 and respiratory protection is required unless a Negative Exposure Assessment is in effect. Respiratory protection shall be provided in compliance with 29 CFR 1926.1101(h) and 29 CFR 1910.134, which require a written respiratory protection program.

8.2.2 Respiratory protection shall also be worn whenever a space must be entered where the potential for exposure to airborne asbestos fibers from sources other than bulk sampling is indicated by the presence of dust and debris or damaged suspect materials.

8.3 Disposable protective clothing shall be worn when entering any location where the potential for contamination by asbestos fibers from sources other than bulk sampling is indicated by the presence of dust and debris or damaged suspect materials. This clothing shall consist of coveralls, hoods and foot coverings of impermeable or breathable fabric, in combination or separately. The choice of fabric should consider the potential for heat stress in the functional space being inspected. Used clothing shall be decontaminated by wet wiping and/or HEPA-vacuuming and disposed of with other consumable supplies used during the inspection.

8.4 Other personal protective equipment to be used as determined by the inspector includes gloves, safety glasses, hard hat, hearing protection, safety shoes and a fall protection harness.

8.5 The inspector shall take necessary precautions against the following safety and health hazards:

8.5.1 Electrical circuits, including those with high voltage. Ground Fault Circuit Interruption shall be provided for all 110 VAC and 220 VAC equipment.

8.5.2 Ladders, scaffolds and catwalks shall be used for access to elevated work sites, and fall protection provided where required.

8.5.3 Crawl spaces, chases, plenums, equipment housings, tanks and other spaces that meet the definition of confined spaces shall be entered in accordance with the precautions in 29 CFR 1910.146, the applicability of that regulation to a Comprehensive Building Asbestos Survey notwithstanding. Particular attention shall be paid to testing the atmosphere in the confined space, providing a breathable air supply if necessary, maintaining communications between persons in the confined space and outside attendants. Precautions shall be taken against getting trapped or otherwise incapacitated in the confined space, and rescue from the space without endangering other persons.

8.5.4 The possibility of chemical hazards during surveys of industrial facilities shall be considered and potential sources of exposure shall be identified through consultation with the appropriate plant staff.

8.5.5 Inspectors are subject to heat stress in boiler rooms, foundries, attics and other hot environments, in addition to outside locations in hot weather. They should recognize heat stress symptoms and be aware of prevention and treatment from the safety segments of their accredited inspector training.

8.5.6 Energized equipment such as pressurized lines and vessels, electrical lines and mechanical devices present potential hazards during the survey. These hazards should be identified through consultation with the building or facility staff, and appropriate lockout/tagout procedures followed by the inspector(s).

APPENDIXES

(Nonmandatory Information)

X1. SAMPLING TECHNIQUES AND EQUIPMENT

X1.1 Sampling Equipment and Supplies

X1.1.1 Assemble the following equipment and supplies in a kit that is dedicated for bulk sampling activities. Make sure that disposable supplies are routinely inventoried and replaced before they are needed. Not all of these items are needed on every sampling job.

X1.1.2 Most of these items are available from ordinary consumer sources. Others can be obtained from safety equipment suppliers.

X1.1.3 Refer to Section 8 for safety and personal protective equipment.

X1.2 General Sampling Procedures

X1.2.1 *Preparation for Sampling*:

X1.2.1.1 Hang warning tape to demarcate the work area and post warning signs to prevent unauthorized persons from entering the area. Close doors to the area when inside a building. If taking samples on a catwalk with open grating, make sure that the levels below have been cleared and secured.

X1.2.1.2 A ladder, if needed, should be taken to the site or other arrangements made for working at elevated locations. Putting the necessary items in a tool pouch around the waist frees the hands for climbing a ladder and taking the sample. The precautions in Section 8 for elevated work must be followed.

X1.2.1.3 Set up necessary equipment (ladder, lighting, etc.). Spread a plastic drop cloth underneath the area where the sample is to be taken. When working outside, you may need to tape the drop cloth in place.

NOTE X1.1—Keeping an extension ladder in place depends on the coefficient of friction between the ladder feet and the surface on which they are resting. A plastic drop cloth has a lower coefficient of friction than the floor, and a loose drop cloth creates a second sliding interface. For this reason, always place the drop cloth under an extension ladder—never place the feet of the ladder on the drop cloth.

X1.2.1.4 For each sample, label a sample container with its identification number and record this identification number, the sample location, and type of material being sampled on a sampling data form. Always place the label on the container itself, not on a lid, as lids can be inadvertently switched by a laboratory analyst handling numerous sample containers. On a floor plan or equipment schematic, mark the location of the sample with the sample identification number. Record sample number, sample location, and a detailed description of the material sampled on a sample data sheet.

X1.2.1.5 Put on your respirator and perform a user seal check. In contaminated areas, put on a disposable protective suit, including head covering if overhead PACM might be disturbed.

X1.2.1.6 Whenever possible, take samples from undamaged, intact material. If samples are taken from material that has been exposed to chemicals in a corrosive atmosphere or from leaking water, these contaminants may interfere with the optical properties on which Polarized Light Microscopy depends for identification of asbestos fibers. If it is necessary to collect samples from damaged areas or areas of discoloration to characterize "patch" insulation or to verify homogeneous areas, note the type, extent, and source of damage.

X1.2.1.7 Do not use plastic bags as sample containers for friable material. If the material is dry, fiber release can occur when you squeeze the air out of the bag before sealing it. If the sample is excessively wet, contaminated water can leak out of the bag.

X1.2.1.8 The procedures for sampling friable materials call for the use of a waste/catch bag or a catch pan to catch debris that may fall while taking the sample.

(1) The waste/catch bag may be either a quart-size or gallon-size sealable plastic bag. It should be labeled "WASTE"

TABLE X1.1

Item	Comments
Catch pans	Rectangular aluminum pans, 3 to 5 in. size, are available in grocery stores
Caulking compound	Used to seal hole left by taking sample
Chisel or scraper blade	The edges will become dull with use and must be kept sharpened.
Coring tubes or tools	Coring tubes or tools help to preserve the integrity of layered samples, allowing each layer to be identified and analyzed separately. Laboratory cork borers are acceptable, and coring tubes can be made from ½ in. copper tubing sharpened on one end. Tubes with detachable handles can be purchased from safety equipment distributors.
Disposal bags	6-mil labeled
Flashlight, drop light and extension cord	A "snake light" worn around the neck leaves hands free
Glue	Household glue (Elmers Glue™ or equivalent)
Hammer	
HEPA-filtered vacuum cleaner[A]	For use in event of a fiber release episode and for evacuating 6-mil disposal bags.
Knife (fixed-blade)	A "TLC" (tile, linoleum, carpet) knife with a hooked blade and sharp point works well for cutting floor tile and other non-friable materials.
Knife (retractable-blade)	A utility knife (box-cutter) with extra blades, or a pocket knife
Paper towels or wet-wipes	
Permanent marker pens	
Plastic drop cloths	6-mil drop cloths can be made from labeled disposal bags. 1 to 2 mil painters' drop cloths are lighter and available in larger sizes. Mark the drop cloth "TOP" on one side.
Mineral spirits	Also sold as paint thinner. Used to clean asphalt based materials from tools.
Rigid sample containers	35 mm plastic film containers or other sealable non-breakable vials
Roofing sealant	Asphalt based—may contain asbestos fibers (check label and MSDS)
Sample labels	The labels should show the date, sample number and the legend "This sample may contain asbestos." One label is affixed to the sample container and a duplicate is placed on (or near) the material sampled.
Screwdrivers	Flat and Phillips-head for removing access panels
Spray bottle with soapy water	The penetrating ability of "amended water" is not as important for bulk sampling as for abatement, and liquid detergent is an adequate surfactant.
Tool pouch	Worn around waist to keep hands free for carrying things and climbing ladders.
Tweezers	
Vinyl electrical tape and duct tape	Used to seal sampling containers and plastic bags
Warning signs and barrier tape	
Waste/catch bag	Sealable plastic freezer bags (quart and gallon size) used to catch debris when sampling some materials and to contain contaminated waste. These bags are easier to carry around than a 6-mil disposal bag. They must be labeled or remain under the control of the inspector until placed in a 6-mil disposal bag when all samples have been taken.
Wettable adhesive lagging cloth	Used to cover holes in insulation

[A] In a settlement agreement with the steel industry, OSHA permits the use of wet methods or a HEPA-filtered vacuum cleaner for Class III work. Since bulk sampling is Class III work according to OSHA, a HEPA-filtered vacuum cleaner is not necessary where wet methods will suffice for clean-up.

with a permanent marking pen. When sampling pipe and duct insulation, tape the bag to the surface beneath where you will take the sample. Because water loosens duct tape adhesive, you must work quickly to collect the sample before the bag falls off. Another problem encountered with using such a bag is keeping it open and positioning it to catch the debris. Putting the strip of duct tape across the seam of the bag instead of along the side will hold it open better. Folding the top of the bag over like a cuff will add rigidity that helps keep it open.

(2) The catch pan can be taped to a wall or other surface, or held under the place where you are taking the sample if duct tape will not stick to the surface (such as fireproofing or plaster).

X1.2.1.9 Catch pans can also be used as temporary sample containers for ceiling plaster and other materials that may be too thin for a coring tool. Immediately after taking the sample, the pan can be collapsed and taped to seal it. Put a sample label on the catch pan (temporary sample container). At a later time, part of the material collected can be transferred to a rigid sample container to be sent to the analytical laboratory and the remainder disposed of, saved for archival purposes or sent to another lab as a split sample.

X1.2.1.10 Complete a chain-of-custody (COC) for each set of samples collected (see 6.4.9.1).

X1.2.2 *Continuation and Completion of Sampling*:

X1.2.2.1 Clean the sampling tools immediately after taking each sample. Place the used paper towels or wet-wipes in a gallon-size sealable bag that has been labeled for suspect asbestos containing waste. Wet-wipe the outside of the sealable bag.

X1.2.2.2 If no more samples are to be taken in the area where you have spread the drop cloth, inspect it for visible debris. Mist the drop cloth with soapy water and wet-wipe visible debris. Carefully fold the sides and corners of the drop cloth to the center with the top side in and place it in a gallon-size sealable bag.

X1.2.2.3 Remove your respirator after finishing the clean-up. If you have been in a contaminated area, wet-wipe the respirator before removing it. If you wear a disposable suit, wet-wipe and remove it and place it in the disposal bag before removing your respirator. If you wore gloves, take them off before removing your respirator.

X1.2.2.4 When all samples have been taken in the area, take down all warning signs and tape and proceed to the next sampling location.

X1.2.2.5 When all samples have been taken in all sampling areas, place the gallon-size sealable bags containing the paper towels, wet-wipes and other debris into a 6-mil labeled disposal bag. Squeeze the bag to evacuate the air from it, tightly twist the neck of the bag, fold it over to form a “goose neck” and securely tape the goose neck. Evacuating the bag will reduce the volume of waste for easier management and will reduce the likelihood of the bag rupturing.

X1.3 Specific Sampling Procedures for Friable Materials

X1.3.1 *Thermal System Insulation*:

X1.3.1.1 *Pipe Insulation* samples must be taken independently from straight runs and fittings, since they are different materials. Straight sections of pipe insulation were factory-made, while the insulation on fittings were typically mixed on site.

(1) If metal jacketing covers the pipe insulation remove the jacketing from the section of pipe being sampled. Make sure that steam lines and hot water lines have been cooled and de-pressurized. Follow lock-out/tag-out procedures. Be careful not to cause fiber release by disturbing adjacent material through excessively vigorous activity (shaking or hitting the pipe, for example). It may be necessary to wrap damaged insulation with 6-mil plastic prior to collecting the sample(s).

(2) Tape a waste/catch bag to the insulation covering beneath the sample location to catch any debris from the sampling operation.

(3) Using the spray bottle, saturate the covering where the sample is to be extracted with soapy water. Cut through the covering with a knife, then wet the insulation.

(4) Use a coring tube or tool to extract a small piece of material, making sure to penetrate all layers of the material. Transfer the material from the coring tube or tool into a rigid container, or put then entire coring tube in the container. Keep the material wet by spraying additional water while extracting the sample. Adding water to the sample in the container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time. Copper coring tubes are preferable for sampling pipe insulation because they do not scratch the pipe, which could cause an explosion. A coring tube 1-¾ in. long will fit in a rigid container. This will suffice for most pipe insulation, which is usually one inch thick regardless of the size of the pipe. Coring tools and tubes work well on firm insulation such as 85 % magnesia, but not as well on materials that “give” such as Aircell. For such materials, remove the material in small pieces with tweezers. Insulation on fittings is firm enough to sample with a coring tool, but very hard cementitious insulation may require a hole saw and hand (not power) drill.

(5) Seal the sample container and wrap a piece of vinyl electrical tape tightly around the lid. Wet-wipe the exterior of the container to remove any material that may have adhered to it during sampling. Place the wet-wipes in the waste/catch bag attached to the covering. Spray and/or wet-wipe the exterior of the pipe, as necessary, to remove any debris that may be present from the sample collection, place the wipe in the waste/catch bag, then remove and seal the waste/catch bag.

(6) To prevent fiber release in the future, fill the hole where the sample was taken with caulking compound or encapsulant that is compatible with the service temperature of the equipment. Spray water into the hole before filling it. Air bubbles in the caulking or encapsulant can cause a fiber release from dry material. Cover the filled hole with adhesive cloth (lag cloth) or duct tape.

(7) Re-install the metal insulation jacket if it was removed. Affix a sample label to the adhesive cloth or duct tape, or on the metal jacket.

(8) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.1.2 *Duct Insulation* on the inside or outside of ventilation ducts may contain asbestos, as may the adhesive or mastic sealing joints on the outside of the insulation.

(1) To sample the lining inside a duct it will be necessary to remove a supply or return grill after ensuring that the ventilation system is turned off, locked out and tagged out.

(2) Wet the lining with soapy water and cut completely through the lining with knife. A piece 1 by 2 in. (3 by 5 cm) is sufficient for a sample. Roll the piece into a cylinder and insert it into a rigid container, seal the lid and affix a sampling label to the container. Affix another label on the outside of the duct or vent near the location of the sample. Wet-wipe or HEPA vacuum the surface of the duct from which the sample was collected to remove any fibers and/or debris that may have been generated in the sample collection process.

(3) Sample the insulation on the outside of a duct in a manner similar to pipe insulation. Tape a waste/catch bag to the insulation covering to catch any debris from the sampling operation.

(4) Using the spray bottle, saturate the covering where the sample is to be extracted with soapy water. Cut through the covering with a knife, then wet the insulation.

(5) Use a coring tube or tool to extract a small piece of material, making sure to penetrate all layers of the material. Transfer the material from the coring tube or tool into a rigid container, or put the entire coring tube in the container. Keep the material wet by spraying additional water while extracting the sample. Adding water to the sample in the container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time. Note—A coring tube 1-¾ in. long that will fit in a 35 mm film container may not be long enough to completely penetrate some duct insulation. Coring tools and tubes work well on firm insulation such as 85 % magnesia, but not as well on some

types of laminated insulation that "give." For such materials, it may be necessary to remove the material in small pieces with tweezers.

(6) Seal the container and wrap a piece of vinyl electrical tape tightly around the lid. Wet-wipe the exterior of the container to remove any material that may have adhered to it during sampling. Place the wet-wipes in the waste/catch bag attached to the covering. Spray and/or wet-wipe the exterior of the pipe, as necessary, to remove any debris that may be present from the sample collection, place the wipe in the waste/catch bag, then remove and seal the waste/catch bag.

(7) To prevent fiber release in the future, fill the hole where the sample was taken with caulking compound or encapsulant. Spray water into the hole before filling it, as air bubbles in the caulking or encapsulant can cause a fiber release from dry material. Cover the filled hole with adhesive cloth (lag cloth) or duct tape. Place a sample identification label at or near the location of the sample.

(8) To sample the mastic covering a seam or at a repair location. on the duct insulation, begin by taping a waste/catch bag to the surface of the insulation below where the sample will be taken. Wet the mastic, which is usually a strip about two inches wide, for about a three-inch length.

(9) Cut through the mastic and the underlying foil or cloth covering with a knife. Peel off the mastic and covering, wetting the covering as you do so and being careful to maintain the integrity of the layers. A piece 1 by 2 in. (3 by 5 cm) is sufficient for a sample. Roll the piece into a cylinder and insert it into a rigid container, seal the lid and affix a sampling label to the container.

(10) Cover the area where you removed the mastic with duct tape or wettable adhesive lagging cloth. Place a sample identification label at or near the location of the sample.

(11) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.1.3 *A Skim Coat* of asbestos-containing material, usually about ⅛ in. thick, sometimes covers fiberglass, foamglass, styrofoam, cork, foam rubber insulation at seams, fitting connections, and on valves, fittings and duct insulation. When sampling this material, it is not necessary to sample the underlying fiberglass, but a note should be made of its existence.

(1) To sample the skim coat, begin by taping a quart-size sealable plastic bag to the covering on the insulation below where the sample will be taken. Wet the covering with soapy water.

(2) Cut through the covering and skim coat with a knife. Peel off the covering and skim coat, wetting the material as you do so and being careful to maintain the integrity of the layers. A piece 1 by 2 (3 by 5 cm) is sufficient for a sample. Roll the piece into a cylinder and insert it into a rigid container, seal the lid and affix a sampling label to the container. Affix another label near where you took the sample. Note—Use a 35 mm film container rather than a small-diameter plastic vial as rolling the material too tightly might cause the layers to separate, or put the sample in a catch pan without rolling or folding the sample.

(3) Cover the area where you removed the sample with duct tape or wettable adhesive lagging cloth.

(4) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.1.4 *Boiler, Breeching and Tank Insulation* is usually thicker than pipe insulation, and may be installed in the form of blocks held in place with wire, metal bands or a wire mesh resembling chicken wire. A skim coat may cover the blocks and fill the spaces between them or cover the wire mesh. The skim coat should be sampled separately or identified as part of a layered sample.

(1) Using the spray bottle, saturate the covering where the sample is to be extracted with soapy water. Remove a piece of the covering with a knife, put the piece in a rigid container, then wet the insulation. Note—Some coring tools may penetrate the covering, in which case it is not necessary to remove a piece with a knife. Some coverings such as tar paper will not absorb water, but wet the surface anyway.

(2) Use a coring tube or tool to extract a small piece of material, making sure to penetrate all layers of the material. Transfer the material from the coring tube or tool into a rigid container, or put the entire coring tube in the container. Keep the material wet by spraying additional water while extracting the sample. Adding water to the sample in the container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time. Note—A coring tube 1-¾ in. long that will fit in a rigid film container may not be long enough to completely penetrate some boiler, breeching and tank insulation. Coring tools and tubes work well on firm insulation such as 85 % magnesia, but not as well on some types of laminated insulation that "give." For such materials, it may be necessary to remove the material in small pieces with tweezers.

(3) Seal the container and wrap a piece of vinyl electrical tape tightly around the lid. Wet-wipe the exterior of the container to remove any material that may have adhered to it during sampling. Place the wet-wipes in the gallon-size sealable bag attached to the covering. Spray and/or wet-wipe the exterior of the pipe, as necessary, to remove any debris that may be present from the sample collection, place the wipe in the waste/catch bag, then remove and seal the waste/catch bag.

(4) To prevent fiber release in the future, fill the hole where the sample was taken with caulking compound or encapsulant. Spray water into the hole before filling it, as air bubbles in the caulking or encapsulant can cause a fiber release from dry material. Cover the filled hole with adhesive cloth (lag cloth) or duct tape.

(5) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.2 *Surfacing Material*:

X1.3.2.1 *Fireproofing* was applied by spraying in most cases, and by troweling in a few instances. The sprayed material is either high-density or low-density, while troweled fireproofing is typically high-density. Some low-density products may have been tamped in place. There may be a protective mastic covering the fireproofing. The sampling procedure for all of these materials is essentially the same.

(1) Fireproofing is found on beams, columns, and other structural members as well as on the underside of the deck. These locations may be accessible with or without a ladder or man-lift, may be in a plenum above a lay-in or solid ceiling, or concealed in a vertical chase or horizontal soffit. Destructive testing to access the material for sampling may be required.

(2) High density and low density fireproofing materials readily release debris during sample collection. Fireproofing samples are difficult to collect directly into a rigid sample container and the action of collecting the sample typically creates falling debris. An added measure of safety can be obtained by using a waste/catch bag according to X1.2.1.8 or a catch pan according to X1.2.1.9.

(3) Using the spray bottle, saturate the fireproofing where the sample is to be extracted with soapy water. If a mastic covering is present, wet the covering and remove a piece as part of the sample.

(4) Use a coring tube or tool to extract a small piece of fireproofing, making sure to penetrate the fireproofing to the substrate. Transfer the fireproofing from the coring tube or tool into a rigid container, or put the entire coring tube in the container. Keep the fireproofing wet by spraying additional water while extracting the sample. Adding water to the sample in the container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time. Coring tools and tubes work well on high density fireproofing, but not as well on low density materials that "give." For softer materials, remove the material in small pieces with a knife and tweezers. Very hard cementitious fireproofing may require a hole saw and hand (not power) drill.

(5) Seal the container and wrap a piece of vinyl electrical tape tightly around the lid. Wet-wipe the exterior of the container to remove any material that may have adhered to it during sampling. Place the wet-wipes in a gallon-size sealable bag.

(6) To prevent fiber release in the future, fill the hole where the sample was taken with caulking compound. If a mastic covering is present, cover the filled hole with adhesive cloth (lag cloth) or duct tape. Affix a sample label to the rigid container, and another to a surface near the place where the sample was taken. (The label may not stick to the fireproofing, but it may stick to the mastic covering of present.)

(7) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.2.2 *Plaster* may be acoustical or decorative in purpose and found on walls as well as ceilings. The plaster may be a single homogeneous layer or it may be one component of a multi-layer wall or ceiling system. The plaster or underlying substrates may be applied to wood lath, metal lath, or a solid surface such as cement grouting. Ordinarily asbestos will be found in the finish coat of a multi-layer system, which is the surface visible from inside the room. However, the inspector must determine all possible locations of asbestos within the system and take samples of all suspect layers, ensuring the integrity of all layers during the sampling and handling processes.

NOTE X1.2—See X1.2.1.8 and X1.2.1.9 regarding the use of waste/catch bags and catch pans for sampling the materials covered in this Section.

(1) Using the spray bottle, wet the plaster where the sample is to be taken with soapy water.

(2) Use a coring tube or tool to extract a small piece of plaster, making sure to penetrate all layers (excluding a cement grout substrate) in a multi-layer system. Transfer the sample from the coring tube or tool into a rigid container, or put the entire coring tube in the container. Keep the material wet by spraying additional water while extracting the sample.

(3) Some plaster coatings are too thin to obtain a sufficient amount of sample with a coring tool or tube. In such cases, use a chisel to scrape the material off the ceiling or wall. It is difficult to direct the material into a rigid container without contaminating the area with debris. Use a catch pan to collect the material as you scrape it off the ceiling or wall, as described in X1.2.1.9. Label the pan with the sample number, fold the pan closed and seal it with duct tape. Adding water to the sample in the container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time.

(4) Affix a sample label to the container, and another to a surface near the place where the sample was taken. (The label may not stick to the plaster.) To prevent fiber release in the future, fill the hole where the sample was taken with patching plaster.

(5) Transfer the material to a rigid container during sample processing. Seal the rigid container and wrap a piece of vinyl electrical tape tightly around the lid. Wet-wipe the exterior of the container to remove any material that may have adhered to it during sample transfer. Place the wet-wipes in a waste/catch bag.

(6) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.2.3 *Textured Finishes* differ from plaster in that they resemble a thick coat of paint and are generally applied to a wallboard substrate. A term commonly used for this material is a "popcorn" finish. This section describes sampling of the textured finish itself, while sampling of the wallboard system and joint materials is covered in X1.3.3.3.

(1) Using the spray bottle, wet the material where the sample is to be taken with soapy water.

(2) Most textured finishes are too thin to obtain a sufficient amount of sample with a coring tool or tube and it is preferable to use a chisel to scrape the material off the ceiling or wall. It is difficult to direct the material into a small rigid container without contaminating the area with debris. Use a catch pan to collect the material as you scrape it off the ceiling or wall, as described in X1.2.1.9. Label the pan with the sample number, fold the pan closed and seal it with duct tape. Adding water to

the sample in the container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time.

(3) Affix a sample label to the container, and another to a surface near the place where the sample was taken. (The label may not stick to the textured finish.) To prevent fiber release in the future, cover the area where the sample was taken with patching plaster.

(4) Transfer the material to a rigid container during sample processing. Seal the rigid container and wrap a piece of vinyl electrical tape tightly around the lid. Wet-wipe the exterior of the container to remove any material that may have adhered to it during sample transfer. Place the wet-wipes in a waste/catch bag.

(5) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.2.4 *Soundproofing* may resemble fireproofing or plaster in its composition and appearance, and may be found on a metal lath or other substrate inside a wall or ceiling, in which case destructive testing may be required to access it for sampling. Soundproofing may have also have been applied as a finish coat to a surface visible and accessible from the room being inspected. Soundproofing may also include acoustical tiles that are applied to walls and ceilings.

(1) For sprayed or troweled-on soundproofing, use the sampling techniques described in X1.3.2.1 for fireproofing and X1.3.2.2 for plaster.

(2) Use the sampling techniques described in X1.3.3.2 for glued-on tiles.

X1.3.3 *Miscellaneous Friable Materials*:

X1.3.3.1 *Acoustical Ceiling Tiles* include lay-in or splined systems. Lay-in tiles are most commonly 2 by 4 ft or 2 by 2 ft in size, while splined tiles are usually the 1 by 1 ft size.

(1) Tiles with different facing colors and surface patterns, or different color interior or top surfaces, should be sampled separately. Select tiles for sampling that can be lifted without disruption of people, equipment or operations.

(2) When lifting the first tile, do so carefully so as not to release fibers and debris from the edges. If there is exposed or damaged asbestos-containing material (fireproofing, thermal insulation or other systems) immediately above the tile, replace the tile carefully and lift another.

(3) Slide the tile over so it rests completely on the adjacent tiles or grid. Wet a small area near the edge. Use a knife to cut off a piece about an inch long and half-inch wide, and place it in a rigid container. Be careful to maintain the integrity of layers. Do not cut through the facing that extends beyond the grid and is visible from below. Keep the tile wet by spraying additional water while removing the sample. Adding water to the sample container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time.

(4) Wet-wipe or HEPA vacuum any debris from the top of the tile and adjacent tiles. Replace the tile slowly so as not to release fibers and debris from the edges.

(5) Affix a sample label to the container, and another to a surface near the place where the sample was taken, such as the ceiling grid if there is one or a surface in the plenum. (The label may not stick to the ceiling tile.)

(6) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.3.2 *Glued-on Tiles* may be affixed to wall or ceiling. The mastic that holds the tile to the substrate often contains asbestos, and may be friable or non-friable. It is normally applied in circular spots two or three inches in diameter.

(1) The tile may be sampled with a coring tool or tube, or with a knife. Remove a small piece of the tile, including the facing material and paint, if present. Put the material in a rigid container, being careful to maintain the integrity of the layers. Keep the material wet by spraying additional water while removing the sample. Adding water to the sample container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time.

(2) If aesthetic reasons preclude damaging the visible surface of the tile, a sample may be obtained by removing an entire tile or a partial tile (less than 1 by 1 ft), taking the sample from the back side of the tile, then gluing the tile back in place. Keep the entire backside and edges of the tile wet to prevent fiber release and use a waterproof adhesive to re-attach it. If sufficient mastic has stuck to the backside of the tile (approximately two cubic centimeters), scrape the mastic off and put it in a separate rigid container. If not, scrape some mastic off the wall or ceiling as described below.

(3) To sample glue spots or mastic on the substrate, wet the mastic and scrape it off with a chisel. Use a catch pan to collect the material as you scrape it off the ceiling or wall, as described in X1.2.1.9. Label the pan with the sample number, fold the pan closed and seal it with duct tape. Adding water to the sample in the container is discouraged because of possible leakage, and because the laboratory will have to dry the sample, which takes extra time.

(4) Affix a sample label to the container, and another to a surface near the place where the sample was taken.

(5) Transfer the material to a rigid container during sample processing. Seal the rigid container and wrap a piece of vinyl electrical tape tightly around the lid. Wet-wipe the exterior of the container to remove any material that may have adhered to it during sample transfer. Place the wet-wipes in a waste/catch bag.

(6) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.3.3 *Wallboard Systems*—The area of most interest in a wallboard system is the vertical joint between two adjacent sheets of wallboard, where asbestos may be found in one or more friable or non-friable materials. The gypsum wallboard core and paper facing generally do not contain asbestos, but is suspect ACM that should be included as part of the sample. Asbestos is most likely to be found in the non-friable joint compound that fills the gap, and the friable texturizer, or skim coat, used in the "tape and float" operation to produce a smooth surface. However, all layers must be sampled and the integrity of the samples maintained.

(1) Wallboard joints are most easily located above a lay-in ceiling, if one is present, where the joint has not been painted or papered over. If the ceiling is solid, a magnetic or electronic

"stud finder" may be used to find the joints. A piece of cove base molding may be pulled back and the sample taken at floor level. Note—If you sample wallboard joint compound behind cove base molding, be sure to keep the cove base mastic out of the sample of joint compound. You could take this opportunity to sample the cove base mastic, but keep it separate.

(2) Tape a gallon-size sealable plastic bag to the wall across the joint and below the place where you will take the sample.

(3) Wet the area around the joint thoroughly with soapy water. Use a knife to cut completely through the tape, joint compound, facing and core. These materials may come out in pieces—keep wetting the material as you remove the pieces. Note—EPA requires that layers of wallboard samples be analyzed and reported separately, but also allows a "composite" result to be reported for purposes of determining if the wallboard "system" contains >1 % asbestos for purposes of complying with the NESHAP. OSHA does not permit sampling or reporting of "composite" results for wallboard systems. Because of the need for information on the individual components of the wallboard system to comply with the OSHA regulations that apply to any work on the material, it is important to maintain the integrity of the separate components during sampling and not homogenize them during sampling or subsequent handling.

(4) Put the sample in a rigid container, seal the lid and affix a sampling label to the container. Affix another label to the wall near where you took the sample. Fill the hole in the wall with caulking compound to prevent further fiber release.

(5) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.3.4 *Sheet Vinyl Flooring,* commonly called "linoleum," has a non-asbestos vinyl facing and a matted or woven backing. The backing is friable unless saturated with adhesive and often contains a high percentage of chrysotile asbestos. Sheet vinyl flooring is sometimes found with more than one underlying layer, or is installed on top of resilient floor tile. In such cases, be sure to maintain the integrity of the layers in the sample.

(1) Select a location where a piece of linoleum can be removed without disrupting people, operations or equipment, or affecting the appearance of the premises. Corners and walls are the most suitable locations. In kitchens and rest rooms, take the sample behind plumbing fixtures and toilets.

(2) Wet the surface of the linoleum with soapy water, then cut through the vinyl facing with a knife. A piece 1 by 2 in. (3 by 5 cm) is sufficient for a sample. Wet the linoleum again where you cut it and allow the water to soak into the backing.

(3) Cut completely through the backing with the knife. Insert the blade of a small chisel or narrow scraper under the backing and pry the piece off the substrate, keeping the backing wet as you do so. Make sure to collect as much of the backing that has stuck to the floor as possible.

(4) Roll the piece into a cylinder and insert it into a rigid container, seal the lid and affix a sampling label to the container. Affix another label near where you took the sample.

(5) To prevent water from migrating under the sheet flooring during custodial activities and also to prevent fiber release, seal the exposed edges of the backing and the floor surface with household glue.

(6) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.3.5 *Vibration Dampeners* that isolate HVAC fans from metal ductwork are often woven from chrysotile asbestos fiber. These components may be readily visible, or they may be underneath fiberglass duct insulation.

(1) If the HVAC system is operating, the integrity of the vibration dampener must be maintained. In this case, look for loose threads protruding from the fabric and cut these off for the sample. Place them in a rigid container, seal the lid and affix a sampling label to the container. Affix another label near where you took the sample.

(2) If the HVAC system is inoperative, cut off a piece of the dampener approximately one inch (2 to 3 cm) square, fold it and place it in a rigid container, seal the lid and affix a sampling label to the container. Affix another label near where you took the sample.

(3) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.3.6 *Gaskets and Packing* containing asbestos are used in a multitude of applications. They are found in mechanical systems and process equipment in all types of buildings and facilities. They come in all shapes and sizes, are friable and non-friable, and may be part of an assembly with non-asbestos materials.

(1) Gaskets and packing are generally installed in energized systems that are under pressure or evacuated. Sampling the gasket requires dismantling of the component in which it is installed. These systems must be de-energized and possibly cooled before the component is disassembled and the sample taken.

(2) The exact procedure for dismantling the component and removing the gasket or packing will vary considerably, depending on whether it is a small valve, a flange in a piping system, an access hatch on a boiler or any of the other applications for gaskets and packing. If the component is to be returned to service after the sample is taken, it should be disassembled by a qualified person who may be someone other than the inspector taking the sample.

(3) Use solvents to loosen bolts and separate flanges sparingly as the solvent might interfere with the optical properties of the gasket or packing material during Polarized Light Microscopy analysis. Separate the flanges slowly and carefully, observing what happens to the gasket as you do so and wetting the gasket material as it becomes visible.

(a) The gasket may come free of both mating surfaces without applying any force. If so, wet a piece small enough to fit into a rigid container, cut it away from the rest of the gasket and put it in the container.

(b) The gasket may adhere to both of the surfaces, delaminating in the middle. If so, wet it on one of these surfaces, scrape a piece off with a chisel and put it in the container.

(c) The gasket may adhere to one of the surfaces, in which case you should wet it, scrape it off the surface with a chisel and put it in the container.

(4) Affix a sample label to the container, and another to a surface near the place where the sample was taken.

(5) Refer to X1.2.2 regarding continuation or completion of sampling.

X1.3.3.7 *Loose Fill Insulation* that has been installed between the joists on top of a ceiling and in wall cavities may contain asbestos-contaminated vermiculite. This material is very friable.

(1) Wet the insulation by gently misting it with a spray bottle.

(2) Using tweezers or a disposable scoop, collect enough insulation to partially fill a 35-mm film container and place it in the container.

(3) Affix a sample label to the container, and another to a surface near the place where the sample was taken.

(4) Refer to X1.2.2 regarding continuation or completion of sampling. Refer to Note 6 regarding analysis of loose fill insulation.

X1.4 Specific Sampling Procedures for Non-Friable Materials

X1.4.1 *Resilient Floor Tile and Mastic*:

X1.4.1.1 Floor tiles of different sizes (usually 9 by 9 in. and 12 by 12 in.), colors and patterns should be sampled separately. Floor tile and mastic should be considered a layered sample, whether the mastic remains on the back of the tile for the laboratory to remove or is collected separately.

X1.4.1.2 Select a location where a piece of tile can be removed without disrupting people, operations or equipment, or affecting the appearance of the premises. Corners and walls are the most suitable locations.

X1.4.1.3 Find an edge, or a seam between two tiles, where a piece of tile 3 to 4 in. (7 to 10 cm) wide can be removed. Remove cove base molding if necessary.

NOTE X1.3—Be sure to keep the cove base mastic out of the sample of floor tile mastic. You could take this opportunity to sample the cove base mastic, but keep it separate.

X1.4.1.4 Wet the surface of the tile with soapy water. Insert a chisel or scraper blade into the seam and tap the chisel or scraper gently with a hammer to insert the blade under the tile, lifting the tile until a piece breaks off. Wet the mastic under the tile as you lift it. The tile may break into smaller pieces than you intended—this is acceptable.

NOTE X1.4—To control the size of the piece you remove, you may want to score the tile where you want it to break. Wet the tile where you score it. A "TLC" (tile, linoleum, carpet) knife, which has a heavy, pointed blade, works best for this purpose.

X1.4.1.5 Wet the backside of the tile and place it in a quart-size sealable plastic bag. Affix a sampling label to the bag and put this bag in a second quart-size bag. Fold the bags tightly around the tile so the bags will not tear, or wrap the pieces of tile in a paper towel.

X1.4.1.6 If there is only a thin layer of mastic on the tile, there may not be sufficient material for analysis. In this case, wet the mastic on the floor with soapy water, scrape off some mastic with the chisel or scraper blade and spread it on the backside of the tile.

NOTE X1.5—Refer to 6.5.1 regarding the analysis of floor tile and mastic and the importance of taking a sufficient quantity of non-friable organically bound (NOB) materials for analysis by TEM. Typically, two cubic centimeters of mastic is necessary for this analysis.

X1.4.1.7 If there is leveling compound under the mastic, include some of this material in the sample. Also sample any vapor barrier or other material underneath the tile. If the tile is installed on plywood underlayment, do not sample the plywood.

X1.4.1.8 Cover the exposed floor and seal the exposed edges of the remaining tile with household glue. If aesthetic appearance matters, put down a piece of replacement (non-asbestos) floor tile. You may want to remove and dispose of (as asbestos waste) the remainder of the tile piece sampled and replace the entire tile.

X1.4.1.9 Refer to X1.2.2 regarding continuation or completion of sampling.

X1.4.2 *Asbestos-cement Materials*:

X1.4.2.1 Asbestos-cement products are the most widely-used asbestos-containing material in the world. They include pipes for water and wastewater, corrugated and flat roofing and siding, panels on cooling towers, ducts for wiring and ventilation, electrical insulating panels, boiler flues and many other uses. A generic term for some products is "Transite," which is actually a trademark for a product with a specific formulation.

X1.4.2.2 Find a location where a sample can be taken without disrupting the function of equipment. Sampling material that is physically damaged is preferable to disturbing intact material, but do not sample material that may have been contaminated by leaking water or corrosive chemicals, or exposed to high temperatures, if possible. Sample from the edge of flat or corrugated material and from the end of pipes and ducts.

X1.4.2.3 Wet the surface with soapy water over an area about one inch (2 to 3 cm) square. The water will not penetrate but will reduce dust and fiber release from the surface. Use a knife to score the material where you intend for it to break.

NOTE X1.6—A "TLC" (tile, linoleum, carpet) knife, which has a heavy, pointed blade, works best for this purpose. Some highly-chlorinated household liquids will soften asbestos-cement products and make them easier to score. Observe appropriate precautions when using these products.

X1.4.2.4 PUT ON YOUR SAFETY GLASSES. Slowly bend the material until a piece breaks off. It may be necessary to use vise-grip pliers to apply the necessary force, and you may have to break off more than one piece to obtain a sufficient sample.

X1.4.2.5 Put the piece(s) in a rigid container, seal the lid and affix a sample label to the container. If the piece will not fit in the container, wrap it in duct tape to keep the sharp edges from tearing the bag and put it in a quart-size sealable plastic bag. Put this bag in a second quart-size bag.

X1.4.2.6 Refer to X1.2.2 regarding continuation or completion of sampling.

X1.4.3 *Roofing Materials* containing asbestos include the built-up membrane, flashings around parapets and penetrations, adhesives and sealants. Many roofing materials have the asbestos fibers embedded in an asphalt matrix. They may be non-friable when installed but become friable through weathering. Light weight concrete roofing decks are suspect asbestos-containing materials. These materials may be sampled during the roofing survey.

NOTE X1.7—A court decision in 1997 specifically excluded roofing cements, mastics and coatings from regulation by OSHA under the asbestos standard for the construction industry. Because it is difficult to separate these substances from other parts of a roofing system and because they present a potential source of fiber release if they become friable, this standard practice advises that they be sampled and analyzed.

X1.4.3.1 Taking a sample of roofing materials creates the possibility of water leakage unless the penetration is properly sealed. For some buildings, the roof warranty may be voided unless this is done by a qualified roofing contractor. NEVER sample roofing materials without the express written permission of the building owner and clear instructions as to who is responsible for sealing the penetrations made by taking the samples.

X1.4.3.2 *Roofing Membranes* may be sampled with a coring tool or tube, making sure to penetrate all layers of the material. The membrane may have several layers and be too thick to use the 1-¾ in. copper tubes that will fit in a 35 mm film container. Transfer the material from the coring tube or tool into a rigid container, or put then entire coring tube in the container. If the membrane has dried out and become friable, keep the material wet by spraying soapy water while extracting the sample.

X1.4.3.3 A reusable coring tool must be cleaned before taking the next sample. The asphalt residue may not come off with soapy water, and you may have to use a solvent such as mineral spirits to clean the tool.

X1.4.3.4 Patch the hole made by the coring tool or tube with roofing sealant, unless the owner has made other arrangements to do so.

X1.4.3.5 Flashings cover penetrations varying in size from two-inch rest room vents to HVAC units several feet on a side, and also cover the joint between the membrane and parapets. The material is usually an asphalt-impregnated cloth or paper and may be painted.

X1.4.3.6 Wet the surface of the flashing with soapy water. Cut off a piece approximately 1 by 2 in. and roll it into a cylinder. Wet the back side of the piece if it is dry and friable. Put the piece in a rigid container, being careful to maintain the integrity of any layers present.

X1.4.3.7 Affix a label to the sample container and to a surface near where you took the sample. (The label may not stick to the flashing.)

X1.4.3.8 Fill the hole left in the flashing with asphalt roofing sealant, unless the owner has made other arrangements to do so. Clean the knife and tools used to apply the sealant with soapy water or mineral spirits. Be aware that some commercially available roof patching compounds may contain asbestos fibers. These products should be avoided and should not be used as a replacement or repair material.

X2. ASSESSMENT PROTOCOLS

X2.1 Purpose and Background

X2.1.1 One objective of a building survey is to provide information on which decisions relating to the management of asbestos-containing materials can be made. This information includes the current condition of the materials and the factors that could result in a deterioration of that condition. Assessment of condition and potential disturbance has been performed according to numerous protocols since the late 1970s.

X2.1.2 Unlike bulk sample analysis and quantification of asbestos-containing materials, assessment is a subjective procedure that relies on observation and informed judgment. However, there are principles that can be followed for validity and consistency of assessments, whether the results are expressed qualitatively or quantitatively.

X2.1.3 It has become common practice to distinguish between assessment of the condition of asbestos-containing materials and their potential disturbance—called the physical assessment—and the assessment of the possible exposure that could result—called the hazard assessment. One reason for this distinction is that the EPA AHERA regulations permit an accredited inspector to do the physical assessment in schools, while an accredited management planner must perform the hazard assessment and recommend response actions based on the assessment. Although these regulations apply only to schools, the concept has been codified in some state regulations and accepted elsewhere. This standard practice considers the assessment process as a comprehensive activity, including condition and potential exposure, without regard to barriers imposed by regulations on who actually can do the assessments.

X2.1.4 Assessments conducted in schools must follow the protocol in 40 CFR Part 763, §763.88—Assessment. Having met that obligation, the inspector is not prohibited from using the protocols in this appendix to further characterize asbestos-containing materials, providing that no conflict with the AHERA regulations is established.

X2.2 Recommended Qualitative Assessment Protocol

X2.2.1 The recommended approach for prioritizing response actions focuses on the two characteristics of asbestos-containing materials that are most indicative of the potential for fiber release: the current condition of the material based on what has already happened to it and the potential for disturbing it, based on what is likely to happen in the future.

X2.2.2 Friable and non-friable suspect asbestos-containing materials are assessed during the inspection. Every homogeneous area is assessed as to the current condition and potential for disturbance as follows:

TABLE X2.1 Qualitative Rankings for Current Condition

Qualitative Ranking	Description of Current Condition	AHERA Analogy
Good	Surfacing material has no visible damage or small amounts of damage; covering on thermal system insulation is intact or has small amounts of damage; miscellaneous materials intact; no visible debris or small amounts of debris.	Undamaged
Fair	Surfacing material has moderate but not extensive amounts of visible damage; covering on thermal system insulation is cut or torn, exposing moderate but not extensive amounts of insulation; moderate but not extensive damage to miscellaneous materials such as floor tile; moderate but not extensive amounts of visible dust and debris.	Damaged thermal system insulation Damaged friable surfacing material Damaged friable miscellaneous material
Poor	Extensive damage to surfacing material; covering on thermal system insulation is cut or torn extensively and insulation itself is damaged; miscellaneous materials such as floor tile extensively damaged and underlying mastic exposed; extensive amounts of dust and debris.	Significantly damaged friable surfacing material Significantly damaged thermal system insulation Significantly damaged friable miscellaneous ACM.

TABLE X2.2 Qualitative Rankings for Potential for Disturbance

Qualitative Ranking (Low, Medium, High) based on:			
Physical Disturbance		Environmental Disturbance	
accessibility during normal operations	activities that people do and how often they do them	vibration from operating machinery, HVAC equipment, and so forth	air currents strong enough to dislodge loose ACM
			airborne dust that can erode material
		water damage from leaking roof, pipe or other source	corrosive atmosphere or liquids that can erode the covering or matrix

TABLE X2.3 Qualitative Assessment Table Example for Two Functional Spaces

Functional Space	Type of ACM	Current Condition		Potential for Disturbance	
		Rating	Based on	Rating	Based on
Office Corridor	SM	Poor	damage, debris	High	activity, accessibility
Mechanical Room	TSI	Fair	debris	Medium	vibration

TABLE X2.4 Qualitative Rankings and Quantitative (Numerical) Ratings for Current Condition

Qualitative Ranking	Description of Current Condition	Numerical Rating
Good	Surfacing material has no visible damage or small amounts of damage; covering on thermal system insulation is intact or has small amounts of damage; miscellaneous materials intact; no visible debris or small amounts of debris.	8 , 9, 10
Fair	Surfacing material has moderate but not extensive amounts of visible damage; covering on thermal system insulation is cut or torn, exposing moderate but not extensive amounts of insulation; moderate but not extensive damage to miscellaneous materials such as floor tile; moderate but not extensive amounts of visible dust and debris.	4 , 5, 6, 7
Poor	Extensive damage to surfacing material; covering on thermal system insulation is cut or torn extensively and insulation itself is damaged; miscellaneous materials such as floor tile extensively damaged and underlying mastic exposed; extensive amounts of debris.	1, 2, 3

X2.2.2.1 *Current Condition*—Based on visual observation by the inspector, including touching to determine friability, the material is qualitatively categorized as shown in Table X2.1. The inspector may use the AHERA damage categories as an aid to classifying asbestos-containing materials if they are in fair (damaged) or poor condition (significantly damaged), according to the analogies shown in Table X2.1. He may also use approximate visual estimations of up to 25 % localized damage and up to 10 % distributed damage to classify a material in fair condition, and over 25 % localized damage and over 10 %

TABLE X2.5 Quantitative Ratings for Potential for Disturbance

Qualatative Ranking	Numerical Ratings	Assessment Factors					
		Physical Disturbance		Environmental Disturbance			
Low Medium High	1, 2, 3 (low) 4, 5, 6, 7 (medium) 8, 9, 10 (high)	accessibility	activites	vibration	air/dust	corrosive	water damage

TABLE X2.6 Example of Quantitative Assessments Ranked by Current Condition and Potential for Disturbance

Functional Space		Type of ACM	Current Condition		Potential for Disturbance	
			Rating	Based on	Rating	Based on
Storage Room	SR	Surfacing material—fireproofing on columns	2	damage, debris	8	activity, accessibility
Mechanical Room	M1	Thermal system insulation—hot water tank	6	damage	8	activity, accessibility
Mechanical Room	M2	Thermal system insulation—pipe fittings	6	damage	5	vibration
Office Corridor	C1	Surfacing material—ceiling plaster	8	damage	2	dust erosion
Office Corridor	C2	Miscellaneous material—floor tile mastic	10	intact	1	inaccessible

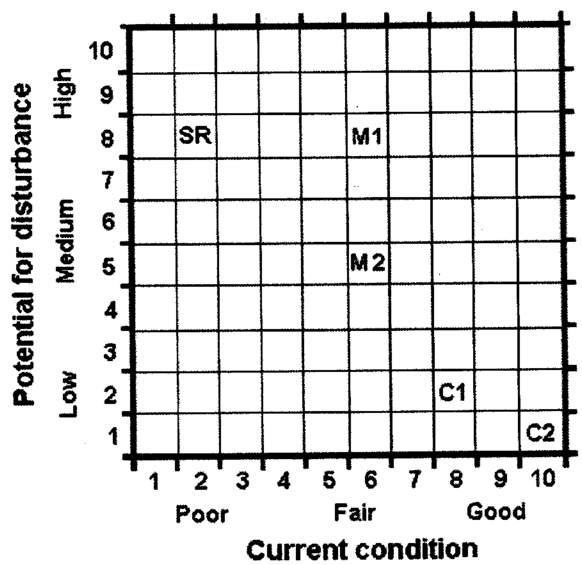


FIG. X2.1 ACM Ratings on Abatement versus O&M Decision Chart

distributed damage to classify a material in poor condition. These percentage criteria are not part of the AHERA regulations but are widely taught in inspector training courses. Quantitative thresholds are used as follows: 1 to 25 % localized damage over the assessment area, would categorize the material as a damaged material. Greater than 25 % localized damage would be representative of significant damage. For distributed damage, 1 to 10 % damage indicates a damaged material and greater than 10 % distributed damage is categorized as a significantly damaged material.

X2.2.2.2 *Potential for Disturbance*—"Disturbance" is as defined by OSHA in the Construction Industry standard for asbestos (29 CFR 1926.1101) as "...activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM" The inspector assesses each homogeneous area for potential physical and environmental disturbance using the factors shown in Table X2.2.

X2.2.2.3 Other physical and environmental disturbances may be taken into account when determining the Potential for Disturbance ranking. For example, air pressure variations in elevator shafts may subject fireproofing to forces that affect its adhesive and cohesive properties. The inspector should describe such factors if they are used in the assessment.

X2.2.3 Every homogeneous area will be subject to a combination of the above factors. The inspector determines the relative importance of each to the overall rating for potential for disturbance. The contributions of physical and environmental disturbance, and their components, should be explained in the report. Combining these factors into a single table will

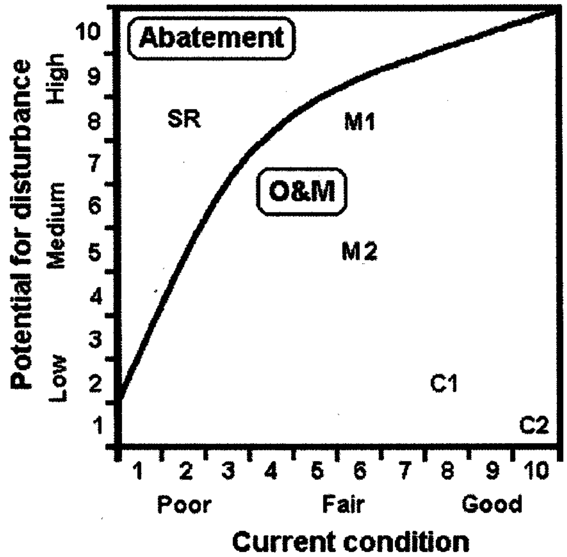


FIG. X2.2 Decision Chart favoring O&M

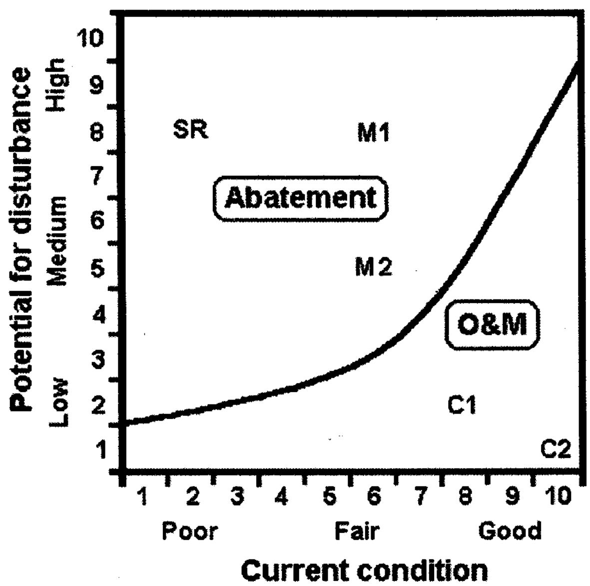


FIG. X2.3 Decision Chart Favoring Abatement

generate a physical assessment of the asbestos-containing material in each functional space, as shown in Table X2.3.

X2.3 Recommended Quantitative Assessment Protocol[6]

X2.3.1 The Quantitative Assessment Protocol recommended by the standard practice uses a graphical technique to apply numerical ratings to the physical assessment factors—Current Condition and Potential for Disturbance—discussed in X2.2 for the recommended Qualitative Assessment Protocol. These ratings are then tabulated and plotted on an Abatement versus O&M Decision Chart to prioritize response actions.

X2.3.2 To use this protocol, Tables X2.1 and X2.2 are first modified by adding numerical ratings corresponding to the qualitative ranges, as shown in Tables X2.4 and X2.5.

X2.3.3 Table X2.6 shows how the ratings for several homogeneous areas are tabulated and sorted by Current Condition and Potential for Disturbance so that the most heavily-damaged and accessible asbestos-containing materials are at the top of the list.

X2.3.4 Fig. X2.1 is the Abatement versus O&M Decision Chart for the Functional Spaces in Table X2.6. The axes of the chart are Current Condition (CC) and Potential for Disturbance (PFD) and the location of the asbestos-containing materials assessed in each Functional Space is shown at the intersection of the ratings for that material. Note that non-friable floor tile

[6] This Quantitative Assessment Protocol is adapted from the *Customized Compliance Program for Asbestos*, copyrighted by Environment-i-media, Inc. (www.environment-i-media.com), and is used by permission.

mastic is assessed at CC = 10 and PFD = 1, indicating that it is not exposed due to missing or broken tiles.

X2.3.5 Fig. X2.2 removes the grid and shows a line separating the Decision Chart into Abatement (above the line) and O&M (below the line) regions. In this example, the line is bent toward the upper left corner to the extent that only the fireproofing in the storage room (SR) is designated for removal. All other asbestos-containing materials will be managed in place through an O&M program.

X2.3.6 The location and shape of the line reflects many aspects of the asbestos management program for the specific facility that has been surveyed. These include the willingness to tolerate some disturbance of asbestos-containing materials, the ability of in-house maintenance staff or an outside contractor to respond to fiber release episodes, the perceptions of building occupants and their attitudes toward asbestos, the complexity and frequency of maintenance and repair if asbestos-containing materials are left in place, and of course the cost of abatement and O&M as alternatives. Fig. X2.2 shows a Decision Chart where the Asbestos Program Manager is disposed toward management of most asbestos-containing materials and removal of only that presenting significant potential for exposure.

X2.3.7 Fig. X2.3 shows a Decision Chart where an Asbestos Program Manager is more inclined toward abatement and will only leave the plaster (OC-1) and floor tile mastic (OC-2) in place, removing the insulation in the mechanical room (MR-1 and MR-2) as well as the fireproofing in the storage room (SR).

X2.3.8 Bear in mind that the Decision Chart is merely a graphical tool for visualizing the relative priorities of abating asbestos-containing materials versus managing them in place, and is meant to complement, rather than replace, the experience and judgment of trained professionals in making their decisions.

X3. FIELD DATA FORMS AND REPORT FORMAT TEMPLATE

COMPREHENSIVE BUILDING
ASBESTOS SURVEY

DATA COLLECTION AND REPORT FORMAT

PROJECT

THIS BUILDING

FIG. X3.1 Survey Cover Sheet

SUSPECT ACM HOMOGENEOUS AREAS

Project Name: ______________________________

Address: ______________________________

Building: ______________________________

Area #	Area Description	Amt	Friable Y/N	Type S/T/M	# of Samples	ACM Y/N/A	Assess

FIG. X3.2 Suspect ACM Homogeneous Areas

LOCATION BY FUNCTIONAL SPACE

Project Name: ______________________________

Address: ______________________________

Building: ______________________________

Description of Functional Spaces

Functional Space Letter	Homogeneous Areas Found in Given Functional Spaces						
	Floor	Base	Wall	Ceiling	Fireproof	TSI	Other

FIG. X3.3 Location by Functional Space

MANNER OF SAMPLING

Date:____________

Description of Manner Used to Determine Sample Locations

Random Sampling (Documented) Homogeneous Area Numbers		Convenience Sampling Homogeneous Area Numbers	

Print Inspectors Name: ____

Signature: ____

Accreditation Agency: __________________________ Accreditation Number: __________

State or EPA Accreditation (circle one) Accreditation Date: __________

FIG. X3.4 Manner of Sampling

X XXXX -- March 9, 2004

HOMOGENEOUS AREAS ASSUMED (NOT SAMPLED) TO BE ACBM

Homogeneou s Area #	Homogeneous Area Description	Functional Space

FIG. X3.5 Homogeneous Areas Assumed (Not Sampled) to be ACBM

MANNER OF SAMPLING DOCUMENTATION

Project Name: ______________________________

Building/ Addition: ______________________________

Homogeneous Area Description: ____________________ #: ________

Functional Space or Room: ______________________________

Floor Plan and Sample Locations:

FIG. X3.6 Manner of Sampling Documentation

BULK SAMPLE LOG

Homogeneous Area Description:	Sampling Manner: circle one: Convenience Random
	Date of Sampling:
Homogeneous Area #:	circle one: Surfacing TSI Misc
Square Feet: / Linear Feet:	circle one: Friable Non-friable
NESHAP: circle one: RACM Cat. I Cat. II	OSHA Removal: circle one: Class I Class II

Number	Location

Homogeneous Area Description:	Sampling Manner: circle one: Convenience
	Date of Sampling:
Homogeneous Area #:	circle one: Surfacing TSI Misc
Square Feet: / Linear Feet:	circle one: Friable Non-friable
NESHAP: circle one: RACM Cat. I Cat.	OSHA Removal: circle one: Class I Class II

Number	Location

Print Inspectors Name: ________________________ Signature: ________________________

Accreditation Agency: ____________________________ Accreditation Number: _________

State or EPA Accreditation (circle one) Accreditation Date: ___________

FIG. X3.7 Bulk Sample Log

CHAIN OF CUSTODY

Client/Project #: ________________ Job #: ____________ Purchase Order #: ________

Send lab report to: ________________________ Lab Destination: ________________

Date Shipped: ________________

Lab Contact: ________________

Attention: ______________________________ Lab Phone Number: ____________

Invoice to: ______________________________ Date Report Required: ____________

______________________________ Client Contact: ________________

______________________________ Client Phone Number: ____________

Sampling Inspector: Print Name: ________________ Signature: ______________________

Sample ID	Sample Description	Date Collected	Remarks

Relinquished By	Date/Time	to	Received By	Date/Time

FIG. X3.8 Chain of Custody

QUALITATIVE ASSESSMENT OF ACM

<table>
<tr><td colspan="2">Owner</td><td colspan="6"></td></tr>
<tr><td colspan="2">Site Address</td><td colspan="6"></td></tr>
<tr><td colspan="2">Building/Addition</td><td colspan="6"></td></tr>
<tr><td colspan="2">Area ID Number:</td><td colspan="2"></td><td colspan="2">Year of construction</td><td colspan="2"></td></tr>
<tr><td colspan="3">Description of Homogeneous Area</td><td colspan="5"></td></tr>
<tr><td colspan="3">Functional Space or Room</td><td colspan="5"></td></tr>
<tr><td colspan="4">Quantity of Material in Homogeneous Area</td><td colspan="4">sq ft ln ft ea</td></tr>
<tr><td colspan="4">Complete during survey: Was material sampled?</td><td colspan="2">Yes - Provide sample number</td><td colspan="2">No - assumed to be ACM</td></tr>
<tr><td>If sample taken, complete when analysis complete</td><td colspan="2">Type(s) of asbestos</td><td colspan="3">Percent asbestos in sample (by type)</td><td colspan="2">No Asbestos Detected (NAD)</td></tr>
<tr><td>Type of Material</td><td colspan="2">Surfacing Material</td><td colspan="3">Thermal System Insulation</td><td colspan="2">Miscellaneous</td></tr>
<tr><td colspan="2">Is material</td><td colspan="3">Friable</td><td colspan="3">Non-friable</td></tr>
<tr><td colspan="3">Qualitative Ranking of Current Condition
(See Appendix X2, Table X2.1)</td><td>Good</td><td>Fair</td><td>Poor</td><td colspan="2">Reason</td></tr>
<tr><td colspan="3">Qualitative Ranking of Potential for Disturbance
(See Appendix X2, Table X2.2)</td><td>Low</td><td>Medium</td><td>High</td><td colspan="2">Reason</td></tr>
<tr><td colspan="3" rowspan="2">Required for schools, optional for other buildings</td><td colspan="2">Damaged</td><td colspan="3">Significantly Damaged</td></tr>
<tr><td colspan="2">Potential for damage</td><td colspan="3">Potential for significant damage</td></tr>
<tr><td>Average Usage of Space</td><td colspan="2">People/hour</td><td colspan="2">Hours/Day</td><td colspan="3">Days/Year</td></tr>
<tr><td colspan="2">Main Occupant Population</td><td colspan="6"></td></tr>
<tr><td colspan="3">Preventive measures which could be taken to reduce potential for disturbance (optional)</td><td colspan="5"></td></tr>
<tr><td colspan="2">Comments</td><td colspan="6"></td></tr>
<tr><td colspan="2">Inspector's Name</td><td colspan="6"></td></tr>
<tr><td colspan="2">License # and State</td><td colspan="2"></td><td colspan="2">EPA Accreditation #</td><td colspan="2"></td></tr>
<tr><td colspan="2">Inspectors Signature</td><td colspan="3"></td><td>Date</td><td colspan="2"></td></tr>
</table>

FIG. X3.9 Qualitative Assessment of ACM

QUANTITATIVE ASSESSMENT OF ACM

Owner			
Site Address			
Building/Addition			
Area ID Number:		Year of construction	
Description of Homogeneous Area			
Functional Space or Room			
Quantity of Material in Homogeneous Area	sq ft ln ft ea		
Complete during survey: Was material sampled?	Yes - Provide sample number	No - assumed to be ACM	
If sample taken, complete when analysis complete	Type(s) of asbestos	Percent asbestos in sample (by type)	No Asbestos Detected (NAD)
Type of Material	Surfacing Material	Thermal System Insulation	Miscellaneous
Is material	Friable	Non-friable	
Quantitative Rating of Current Condition (See Appendix X2, Table X2.4)	1 -10	Reason	
Quantitative Rating of Potential for Disturbance (See Appendix X2, Table X2.5)	1 -10	Reason	
Required for schools, optional for other buildings	Damaged	Significantly Damaged	
	Potential for damage	Potential for significant damage	
Average Usage of Space	People/hour	Hours/Day	Days/Year
Main Occupant Population			
Preventive measures which could be taken to reduce potential for disturbance (optional)			
Comments			
Inspector's Name			
License # and State		EPA Accreditation #	
Inspectors Signature		Date	

FIG. X3.10 Quantitative Assessment of ACM

Site-Specific Standard Operating Procedure for Soil Sample Collection

SOP No: CDM-LIBBY-05 Revision 1

Project: Libby Asbestos Remedial Investigation – Contaminant Screening Study (CSS)/Remedial Investigation (RI)

Project Number: 3282-137

Prepared by:	Thomas E. Cook Environmental Scientist	4/3/02 Date
	Dee A. Warren, Revision 1 Project Scientist	4/17/03 Date
Approved by:	______________________ Project Manager	Date
	______________________ Technical Reviewer	Date
	______________________ QA Reviewer	Date
	______________________ EPA Approval	Date

Section 1
Purpose

The purpose of this standard operating procedure (SOP) is to provide a standardized method for surface soil sampling to be used by employees of EPA Region VIII contractors/subcontractors supporting EPA Region VIII CSS and RI activities for the Libby Asbestos Project in Libby, Montana. This SOP describes the equipment and operations used for sampling surface soils in residential areas, which will be submitted for the analysis of Libby amphiboles. The EPA Region VIII remedial project manager, or on-scene coordinator must approve site-specific deviations from the procedures outlined in this document prior to initiation of the sampling activity. This SOP provides the protocols for composite surface-soil sampling.

Section 2
Responsibilities

Successful execution of the sampling and analysis plan (SAP) requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role.

The CSS/RI task leader is responsible for overseeing the CSS/RI residential surface soil sampling activities. The CSS/RI task leader is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and the SAP. It is the responsibility of the CSS/RI task leader to communicate with the field personnel specific collection objectives and anticipate situations that require any deviation from the SAP. It is also the responsibility of the CSS/RI task leader to communicate the need for any deviations from the SAP with the appropriate EPA Region VIII personnel (remedial project manager or on-scene coordinator).

Field personnel performing soil sampling are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples at residences. The field personnel should have limited discretion with regard to collection procedures but should exercise judgment regarding the exact location of the sample point, within the boundaries outlined by the CSS/RI task leader.

Section 3
Equipment

- Sample container - The sample container will consist of quart-sized zip-top plastic bags (2 per sample).
- Trowel - For collecting surface soil samples.
- Bulb planter - For collecting surface soil samples.
- Shovel - For collecting surface soil samples.
- Stainless steel mixing bowl - Used to mix and homogenize composite soil samples after collection.
- Gloves - For personal protection and to prevent cross-contamination of samples. May be plastic or latex. Disposable, powderless.
- Field clothing and personal protective equipment (PPE) - As specified in the health and safety plan (HASP).
- Field sprayers - For decontaminating nondisposable sampling equipment between samples will be used.
- Silica sand - For field equipment blank quality control (QC) samples.
- Wipes - Disposable, paper. Used to clean and decontaminate sampling equipment.
- Field logbook -Used to record progress of sampling effort and record any problems and field observations.

- Information Field Forms (IFF) - Used to record information such as property detail, location of amphibole contamination, and estimated quantities.
- Field Sample Data Sheet (FSDS) - Used to record soil sample information.
- Permanent marking pen - Used to label sample containers.
- Index ID stickers - Used to label sample containers.
- Plastic buckets - Used to wash nondisposable field equipment between samples.
- Trash bag - Used to dispose gloves and wipes.
- Cooler - Used to store samples while in the field.
- Chain of Custody Record - For ensuring custody of samples until shipping.
- Custody Seals - For ensuring custody of samples during shipping.

Section 4
Sampling Pattern

Each property will be segregated into land use areas for sampling purposes. Use areas may include but not be limited to:

- Yard (grassy area)
- Landscaped area
- Garden
- Fill area
- Driveway

Properties with grassy areas greater than ½ acre in size will be sectioned off into separate zones for increased accuracy in characterization. Sectioning properties into additional zones will be at the discretion of the CDM field team leader but consistent among the teams. This segregation will be accomplished so that a five-point composite sample will characterize the section. A five-point composite sample will be collected for land areas less than or equal to 1/8 of an acre.

Up to five composite soil samples will be collected at each property. Composite sampling requires soil collection from multiple (sub-sample) points. Composite samples will be collected from similar land use areas (i.e., yard, garden, stockpiled soil, etc.). Additional composite or grab samples may be collected dependent upon site conditions (i.e., multiple land use areas, zones, etc.). Conversely, not all land areas previously mentioned will be applicable at every property and fewer (not less than two) will be collected.

For non-disturbed areas (i.e., yard), composite samples will be collected from 0 to 1 inch (in.). For disturbed areas (i.e., driveway garden, fill area, landscaped areas, etc.), composite samples will be collected from 0 to 6 in. All composite soils samples will have five subsamples (i.e., five-point composite sample) of approximately equal size.

If vermiculite is observed in large land use areas (driveway and yards), one sample should be collected from each area. Any other land use areas where vermiculite product is visible will not be sampled. Instead, the location will be recorded in the field logbook and on the IFF.

Section 5
Sample Collection

Don the appropriate PPE as specified in the HASP. A new pair of plastic gloves are to be worn for each sample collected. Segregate land use areas on the property as described in Section 4. Visually inspect each land use area for visual vermiculite product. To reduce dust generation during sampling, use a sprayer with deionized water to wet each sample point prior to collection. Use the trowel to check beneath the surface soil layer, but do not advance more than 6 in. If visible vermiculite is observed, record information in the appropriate field forms and do not collect a sample from that land use area. If visible vermiculite is not observed, proceed with sample collection.

Within each land use area, select five subsample locations equidistant from each other. These five subsample locations will comprise the five-point composite sample for that land use area. All composite subsamples will originate from the same land use area. For example, do not mix subsamples from garden areas with subsamples from grassy areas.

Clean the subsample locations of twigs, leaves, and other vegetative material that can be easily removed by hand. Using the trowel, excavate a hole in the soil approximately 2 in. in diameter and 1 in. deep (6 in. for disturbed areas) while placing the excavated material directly inside the mixing bowl. The sides of the excavated hole should be close to vertical to avoid sampling that is biased in favor of the upper layer of soil. Repeat this step for each subsequent subsample until the appropriate number of composite subsamples has been collected.

Homogenize the sample using the sampling trowel. Once the sample is homogenized, fill the zip-top plastic bag to 1/3rd full (approximately 2000 grams). Affix the sample index identification (ID) sticker to the inside of the bag and write the index ID number on the outside of the bag. Double bag the sample and repeat the labeling process for the outer bag. Decontaminate equipment between composite samples as described in Section 8.

Repeat steps outlined above until all samples from a property have been collected.

Soil field duplicate samples will be collected at a rate of 1 per 20 (5 percent) of the field samples. Field duplicate samples will be collected as samples co-located in the same land use area. The duplicate will be collected from the same number of subsamples as the parent sample, but the subsample locations of the duplicate sample will be randomly located in the use area. These samples will be independently collected with separate sampling equipment. These samples will be used to determine the variability of sample results in a given land use are. These samples will not be used to determine variability in sampling techniques.

Section 6
Site Cleanup

Specific instruction regarding site cleanup of investigation-derived waste (IDW) is included in CDM SOP 2-2, Guide to Handling Investigation-Derived Waste, with modification. In general, replace soil plug with excess sample volume. The soil should be placed back into the hole and tamped down lightly. If sandy areas such as playgrounds are sampled, refilling the soil plug is not necessary.

Rinse water, the roots of vegetation removed during sampling, and any excess soil volume may be disposed of on the ground as specified in the SAP.

Section 7
Record Keeping and Quality Control

A field logbook should be maintained by each individual or team that is collecting samples as described in the SAP. The SAP will detail specific conditions (SOP 4-1), which require attention, but at a minimum the following information should be collected:

- Date
- Time
- Team members
- Weather conditions
- PPE used
- Locations of any samples and subsamples that could not be acquired
- Descriptions of any deviations to the SAP and the reason for the deviation

Complete the IFF and FSDS for each property/sample.

Quality control samples will include:

- Field duplicates
- Equipment blank samples

Detailed information on QC sample collection and frequency is included in the SAP.

Section 8
Decontamination

All sampling equipment must be decontaminated prior to reuse. Specific instructions on sample equipment decontamination are included in CDM SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites, with modification. In general, the procedure to decontaminate all equipment is outlined below:

Decontamination procedures for soil sampling equipment will follow these steps:

- Remove all gross contamination with plastic brush
- Use DI water and a plastic brush to wash each piece of equipment
- Remove excess water present on the equipment by shaking
- Use a paper towel to dry each piece of equipment
- Wrap dried equipment in aluminum foil

Once a week all soil sampling equipment will be cleaning using Alconox and DI water.

Spent wipes, gloves, and PPE must be disposed or stored properly as specified in the SAP.

Section 9
Glossary

<u>Sampling and Analysis Plan (SAP)</u> - The written document that spells out the detailed site-specific procedures to be followed by the project leader and the field personnel.

<u>Sample Point</u> - The actual location at which the sample is taken. The dimension of a sample point is 2 in. across by 1 in. deep (6 in. for disturbed areas).

<u>Composite Sampling</u> - A sample program in which multiple sample points are compiled together and submitted for analysis as a single sample.

<u>Land Use Area</u> - A section of property segregated by how the property owner uses the section. For example, garden landscaped areas are individual land use areas. Grassy areas (i.e., lawn) are also considered to be a separate land use area.

Standard Operating Procedure
CSF eLASTIC Module

SOP No.: CDM-LIBBY-07 (revision 1)

Project: Libby Asbestos Project

Prepared by: David Knight 1/29/04
Database Analyst

Approved by: ______________________________ ____________
Project Manager Date

______________________________ ____________
Technical Reviewer Date

______________________________ ____________
QA Reviewer Date

______________________________ ____________
EPA Approval Date

Contents

Figure

Section 1
Introduction

The close support facility (CSF) electronic Libby asbestos sample tracking information system (eLASTIC) database is used to track information generated from the processes presented in the soil preparation plan (SPP) (CDM 2004). The purpose of this document is to provide the standard operating procedures (SOP) for operating eLASTIC in support of SPP as well as provide a general overview of the database system including security backups, exports, and an entity relationship diagram.

1.1 eLASTIC Overview

eLASTIC is a Microsoft Access application designed to perform various tasks in support of the sample preparation process at the CSF. These tasks include data entry screens for inventory, dry batches, prep batches, chain-of-custodies (COCs), and quality control (QC) samples. Some of the data is transferred to Libby2 by using the eLASTIC data transfer services (see Section 3 for details). eLASTIC is also used to create COC reports, which are sent to the laboratory with the samples.

1.2 Document Layout

This document contains procedures that are specific to the application. The following text formats are used to describe various user actions.

- *Note: This is a note* – notes are used to further explain a process.
- <u>Add Samples</u> - an underlined phrase indicates the user should click a button that contains the text that is underlined.
- *Tools ->Compact Database* – italic phrases indicate a menu item. The text that precedes the -> is the menu (sub) title. The text that proceeds the -> is the menu item the user should select.
- <Form name> - indicates a user form; such as: <Main Switchboard>.
- [Field Name] – indicates a field name (i.e., column header); such as: [Index ID].

Section 2
General Operations

The general operations of eLASTIC include data entry, data entry QC, and production of COCs. These operations center around four central activities at the CSF:

- Sample receiving
- Sample drying
- Sample processing (i.e., sieving, grinding, and splitting)
- Sample shipping

2.1 Inventory Batch

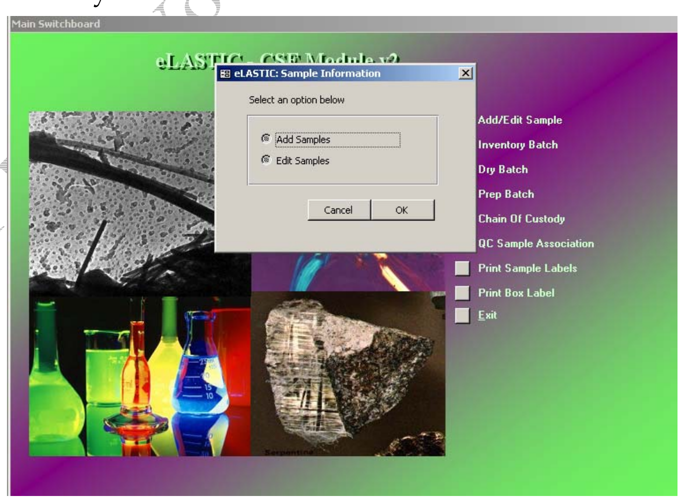
When samples are received at the CSF they are assigned to an inventory batch. Each sample is given an inventory batch id and a box letter. For example, 116 A indicates the sample belongs to inventory batch 116, box A. The purpose of the inventory batch is to provide a system for tracking and filing samples received at the CSF.

Note: A sample must be assigned to an inventory batch before it can be dried, prepped, and shipped.

2.1.1 Adding Inventory

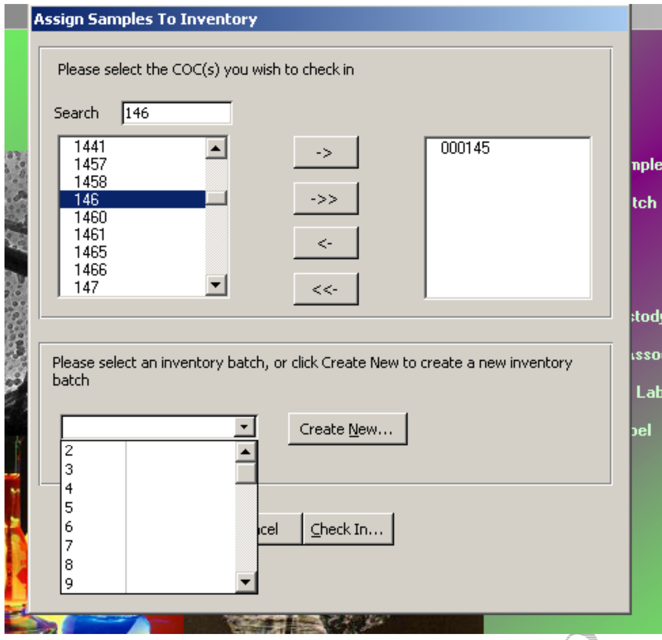
The following procedure describes the process for adding a sample to inventory.

1. Select Inventory Batch from <Main Switchboard>. Select Add Inventory from the dialog box and click Continue…. This brings up the <Assing Samples to Inventory> form.



2. Select the COCs to assign to inventory from the left-hand listbox. Click the > to move the selected COCs to the right-hand listbox.

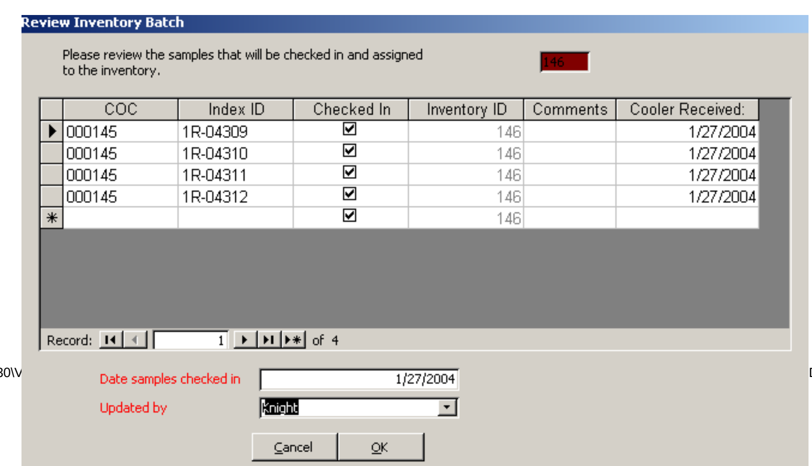
Note: Electronic COC updates are sent from the Libby eLASTIC database prior to samples arriving at the CSF.



3. At this point the COCs can be assigned to an already existing inventory batch, or a new inventory batch.
    a. To assign them to an already existing batch, simply select the batch number from the drop-down box.
    b. To assign them to a new batch click Create New…. Select the user name in the [Created By] drop-down box on the dialog form, and click OK. Or, click Cancel to cancel the operation.

4. Click Check In…. This brings up the <Review Inventory Batch> form. This shows the individual samples that are to be assigned to the specific batch. Samples can be added or removed at this screen. This is where the QC samples are assigned to inventory (see section 3 for details). Select the sample from the [Index ID] drop-down box.

5. Once the review is complete, click OK. If the sample has already been assigned to inventory, a message will appear, and the [Checked In] box will become unchecked.



Note: Any sample that has the [Checked In] box unchecked is not assigned to inventory.

6. A <Sample Check-in Report> appears in a print preview. Select *File->Print* to print the report.

2.1.2 View Inventory Batch

The following procedure is used to view an inventory batch.

1. Select Inventory Batch from <Main Switchboard>. Select View Inventory batch and the desired batch number from the drop-down box from the dialog box. Click Continue….

2. A <Sample Check-in Report> appears in a print preview. Select *File->Print* to print the report.

2.2 Dry Batch

Once samples have been assigned to inventory, they may be assigned to dry batches.

Notes:

- *Dry batches are independent of inventory batches. That is, samples from multiple inventory batches can be grouped into one dry batch.*

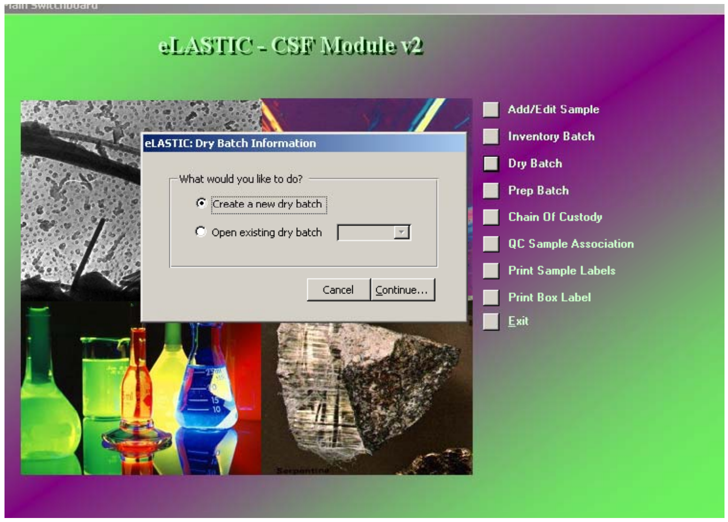
- *A sample can be assigned to more than 1 dry batch. This would occur when a sample needs to be dried more than once.*

- *A sample must be assigned to at least one dry batch before it can be prepped or shipped.*

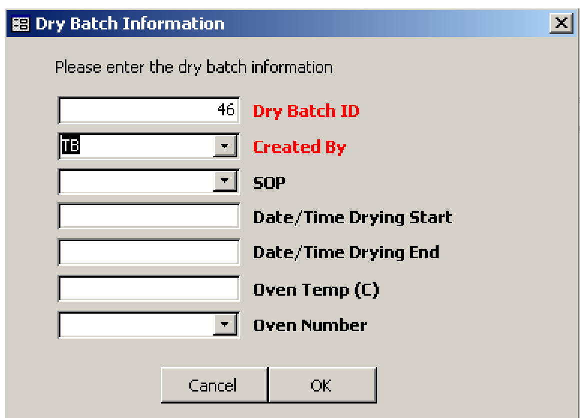
2.2.1 Create Dry Batch

The following procedure is used to describe the process for creating a dry batch and assigning samples to the batch.

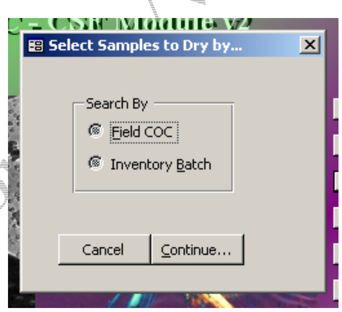
1. Select Dry Batch from <Main Switchboard>. Select Create a new dry batch from the dialog box. Click Continue….



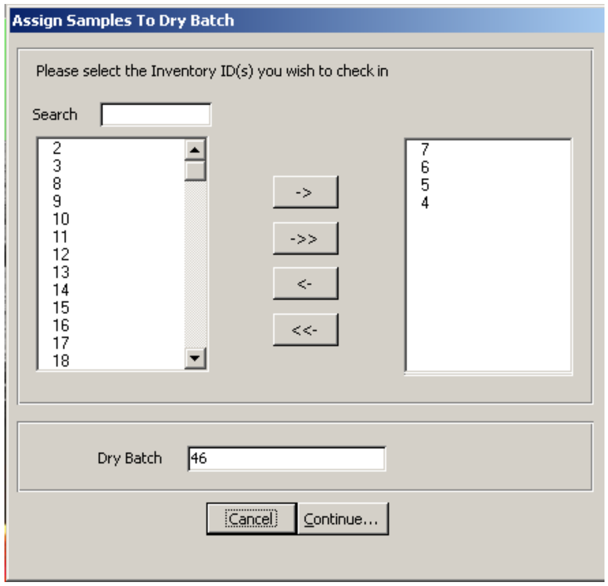
2. Select the user name from the [Created By] drop-down box on <Dry Batch Information>. Click <u>OK</u> to create the batch, or click <u>Cancel</u> to cancel the batch.



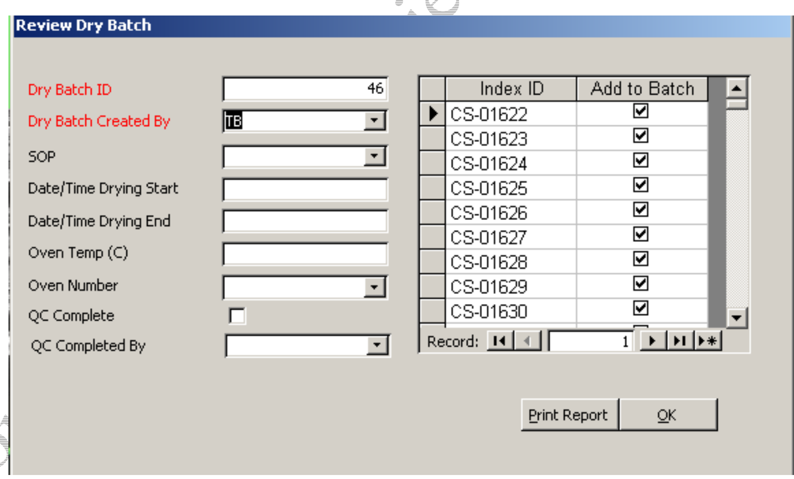
3. Select the search option from <Select Samples to Dry by…>. Click <u>Continue…</u>.



4. Select the items (this depends on what search option was selected on step 2) in the left-hand listbox . Click the > to move the selected items to the right-hand listbox. Click <u>Continue…</u> when all desired items are in the right-hand listbox.



5. The <Review Dry Batch> form is now displayed. Samples may be added or removed at this point. Any dry batch information can be added at this point as well. When the review is complete click <u>Print Report</u> to print the dry batch report. The drying date/time start and end, oven number, oven temperature, SOP, and the sample weights before and after along with initials should be filled out by the technician responsible for drying that particular batch. This information, less the weights, should be entered in eLASTIC (see Open Existing Dry Batch for instructions).



6. Click <u>OK</u> to close the batch. If a sample does not exist in inventory then the [Add to Batch] will become unchecked.

Note: Any sample that has the [Add to Batch] box unchecked is not assigned to inventory.

2.2.2 Open Existing Dry Batch

The following procedure is used to describe the process for opening an existing dry batch so it may be edited or printed.

1. Select Dry Batch from <Main Switchboard>. Select Open existing dry batch from the dialog box, and select the dry batch from the drop-down box. Click Continue….

2. The <Review Dry Batch> form is now displayed. Samples may be added or removed at this point. The information from the Dry Batch Report is entered in this form. [SOP], [Date/Time Drying Start], [Date/Time Drying End], [Oven Temp C], and [Oven Number] should be filled in after the dry batch report has been filled out.

Note: The Date/Time Drying Start and Date/Time Drying End should be entered in m/d/yy h:mm am/pm. For example, January 29, 2004 3:45 pm would be entered as: 1/29/04 3:45 pm

3. The [QC Complete] and [QC Completed By] should be filled out AFTER the QC has been complete.

4. Click OK to close the batch.

2.3 Prep Batch

Once samples have been assigned to a dry batch, they may be assigned to a prep batch.

Notes:

- *Prep batches are independent of both inventory batches and dry batches. That is, samples from multiple inventory batches and multiple dry batches can be grouped into one prep batch.*

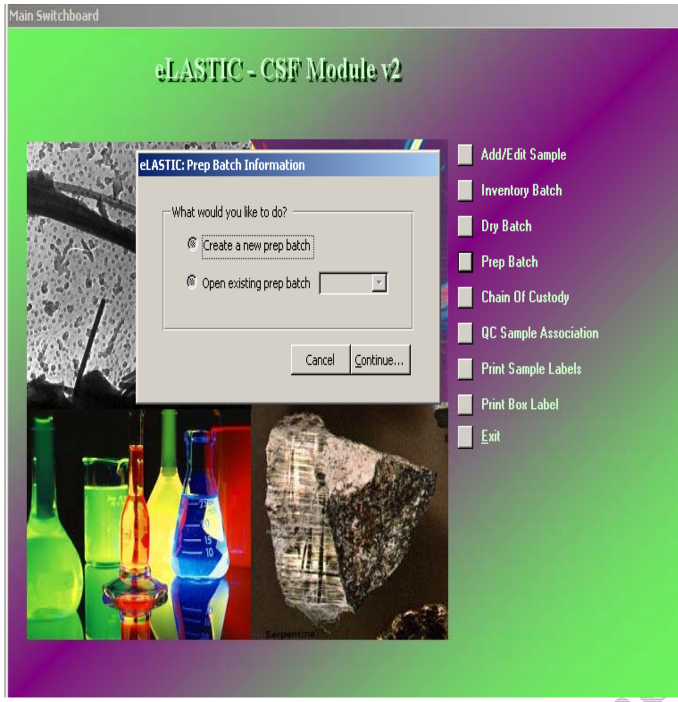
- *A sample can only be assigned to 1 prep batch.*

- *A sample must be assigned to at least one prep batch before it can shipped.*

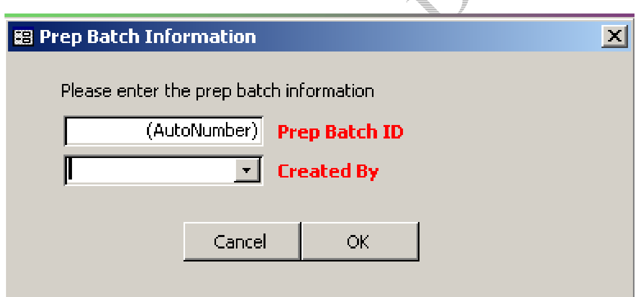
2.3.1 Create Prep Batch

The following procedure is used to describe the process for creating a prep batch and assigning samples to the batch.

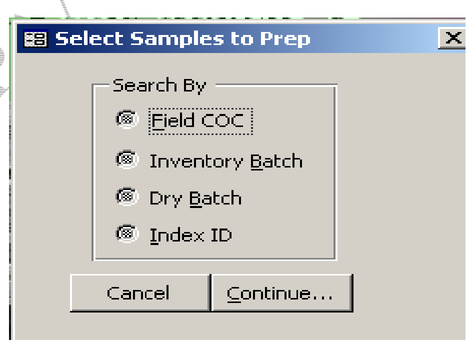
1. Select Prep Batch from <Main Switchboard>. Select Create a new prep batch from the dialog box and click Continue….



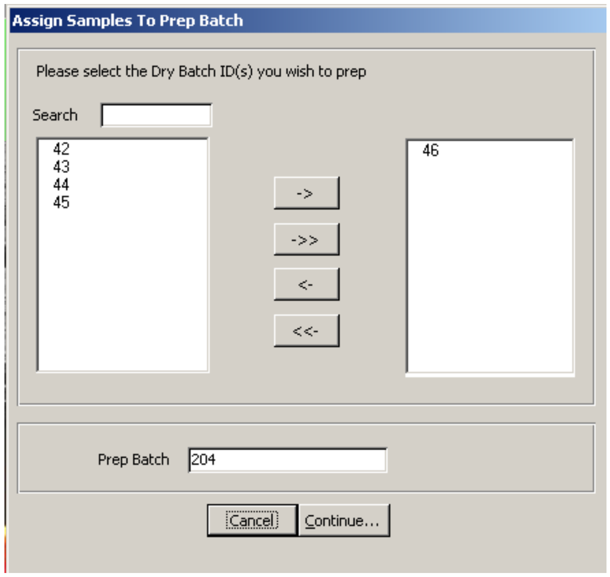
2. Select the user name from the [Created By] drop-down box on <Prep Batch Information>. Click <u>OK</u> to create the batch, or click <u>Cancel</u> to cancel the batch.



3. Select the search option from <Select Samples to Prep>. Click <u>Continue….</u>

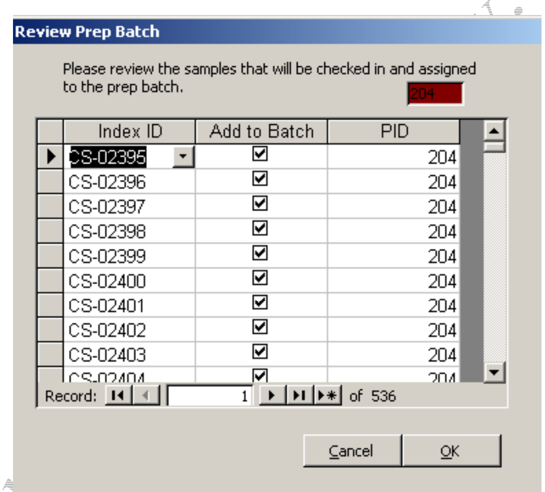


4. Select the items (this depends on what search option was selected on step 2) in the left-hand listbox . Click the > to move the selected items to the right-hand listbox. Click <u>Continue…</u> when all desired items are in the right-hand listbox.



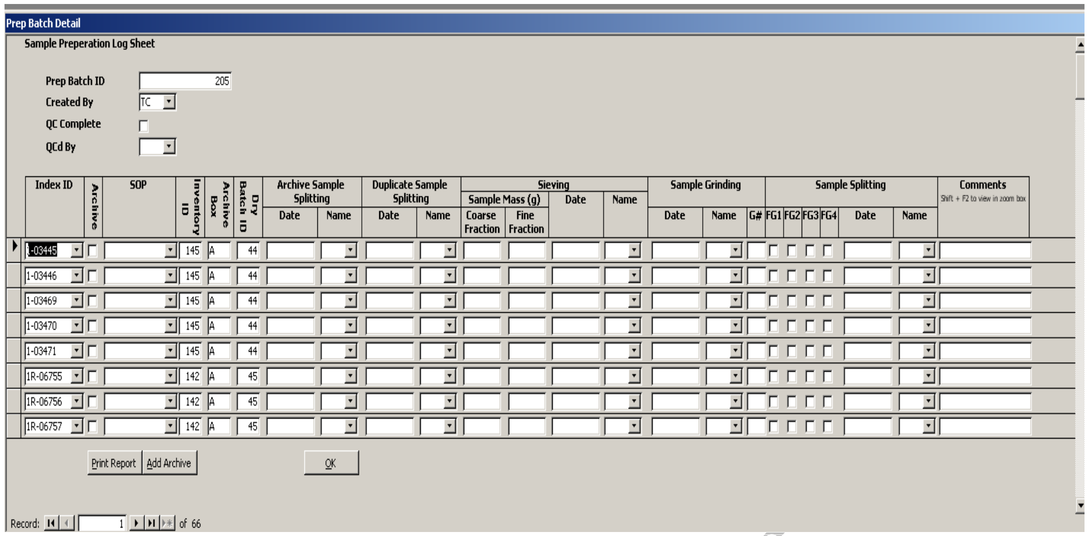
5. The <Review Prep Batch> form is now displayed. Samples may be added or removed at this point.

6. Click OK to view the <Prep Batch Detail> form. If a sample does not exist in a dry batch or has already been assigned to a prep batch, then the [Add to Batch] will become unchecked.



Note: Any sample that has the [Add to Batch] box unchecked is not assigned to a dry batch or it has already been assigned to a prep batch.

7. The <Prep Batch Detail> form is where all of the prep information is entered. This is also where the Prep Batch Report is printed. Click Print Report to print report. The report should be filled out by the technician who is prepping the batch. Once the form has been filled out, the information should be entered in eLASTIC (see Open Existing Prep Batch for instructions).



8. Click OK to close the batch.

2.3.2 Open Existing Prep Batch

The following procedure is used to describe the process for opening an existing prep batch so it may be edited or printed.

1. Select Prep Batch from <Main Switchboard>. Select Open existing prep batch from the dialog box, and select the prep batch from the drop-down box. Click Continue….

2. The <Prep Batch Detail> form is now displayed. The information from the Prep Batch Report is entered in this form. The information should be filled in after the prep batch report has been filled out. The fine ground weights are not recorded. Rather, a checkbox for each of the 4 portions should be checked.

3. The [QC Complete] and [QC Completed By] should be filled out AFTER the QC has been complete.

4. Click OK to close the batch.

2.4 Chain-of-Custody

Once samples have been prepped, they may be assigned to a COC.

Notes:

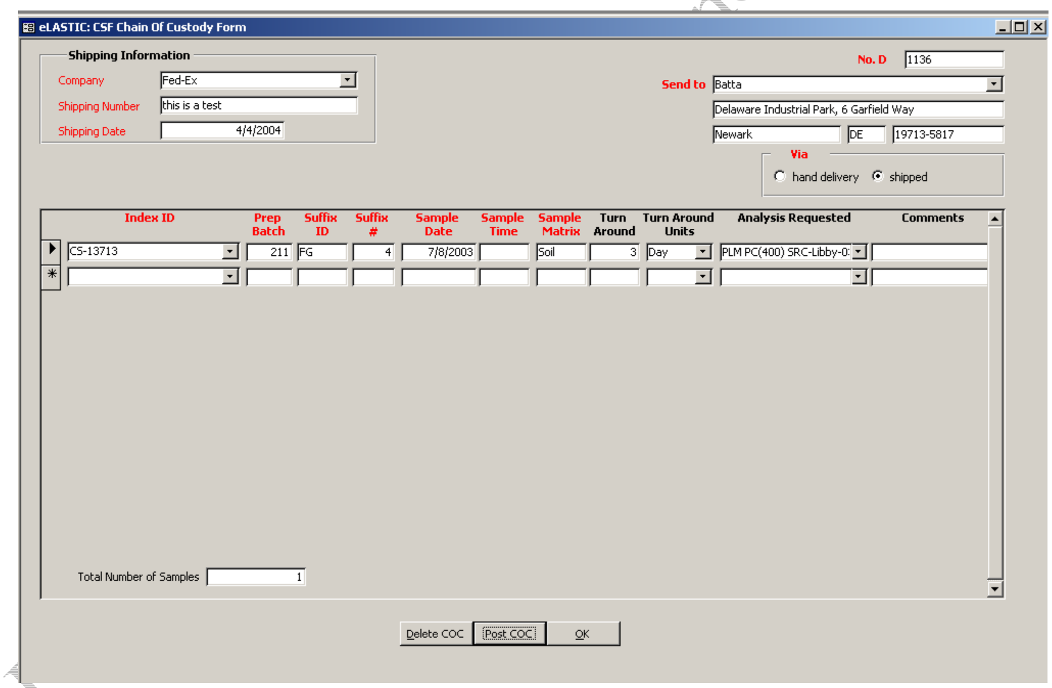
- *COCs are independent of inventory batches, dry batches, and prep batches.*
- *A sample fraction (e.g., C, FG1, FG2, FG3, etc.) can only be assigned to one COC.*

2.4.1 Create COC

The following procedure is used to describe the process for creating a COC and assigning samples to the COC.

1. Select Chain-Of-Custody from <Main Switchboard>. Select Create COC from the dialog box and click Continue….

2. The <CSF Chain-of-Custody Form> is displayed. The chain-of-custody number will automatically be filled in by eLASTIC.



3. Select the laboratory from the [Send To] drop-down box.

4. In the Via area, select the method that will be used to deliver the samples to the laboratory.

5. Complete the shipping information by filling in the [company], [shipping number], and [shipping date].
6. Complete the [Index ID] field using the drop down list to select the index ID. The [prep batch number], [suffix ID], [suffix number], [sample date], [sample time], [sample matrix], and [mass fraction] will automatically be completed.

7. Complete the [turn around time] by typing in the appropriate number of days or hours. Then select the appropriate units from [Turn Around Time Units].

8. Complete the [analysis requested] field using the drop down list.

9. Enter any desired comment in the [comments] field.

10. If the COC is complete and ready to be printed for delivery, click Post COC. Or, click OK to close the COC.

Note: The COC can be deleted by clicking Delete COC.
Note. If the COC has been posted, the Post COC button is replaced with the Unlock COC button. Once a COC has been posted, the COC is locked and cannot be edited without selecting the Unlock COC button.

2.4.2 Open Existing COC
The following procedure is used to describe the process for opening an existing COC so it may be edited or printed.

1. Select Chain Of Custody from <Main Switchboard>. Select Open existing COC from the dialog box and click Continue…. Select the COC from the drop-down box in the dialog box. Click OK.

2. The <CSF Chain of Custody Form> is displayed. The COC may be edited, printed, or deleted.

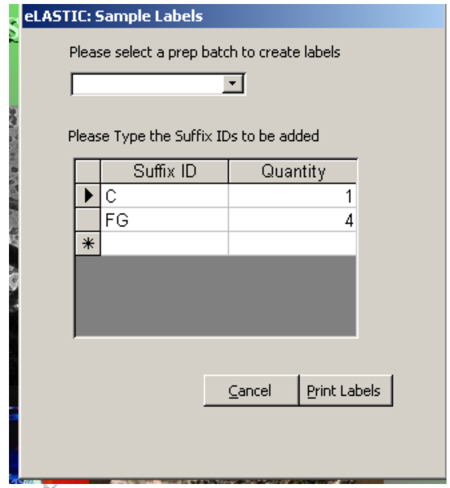
3. Click Post COC to post the COC, or click OK to close the COC.

2.5 Labels
There are 2 labels that are printed from eLASTIC. Sample labels are used for the sample bags, and box labels are used for the boxes.

2.5.1 Sample Labels
Sample labels identify the sample and portion of the sample. They are printed on Avery 5267 labels. The following procedure is used to describe the process for printing sample labels.

1. Select Print Sample Labels from the <Main Switchboard>.

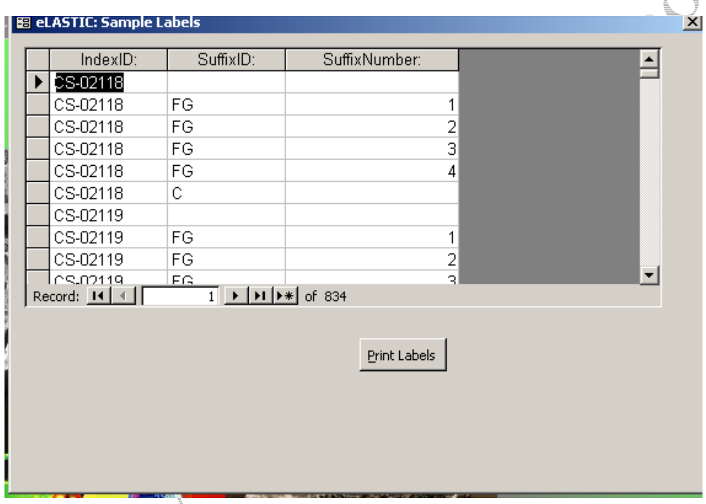
2. Using the drop down list, select the prep batch number to print sample labels for.



3. Enter each suffix id needed (e.g., C, FG, AFG, etc…) in the Suffix ID column.

4. Enter the quantity of each suffix needed in the Quantity column. For example, to print a label for FG1, FG2, FG3, and FG4 the quantity will be 4.

5. Click Print to review labels. If corrections are needed close the preview screen and make appropriate corrections; otherwise, print the labels by selecting *File->Print*.



2.5.2 Box Labels

Box labels identify the inventory batch, box number, and the samples contained in the box. The following procedure is used to describe the process for printing box labels.

1. Select Print Box Label from the <Main Switchboard>.

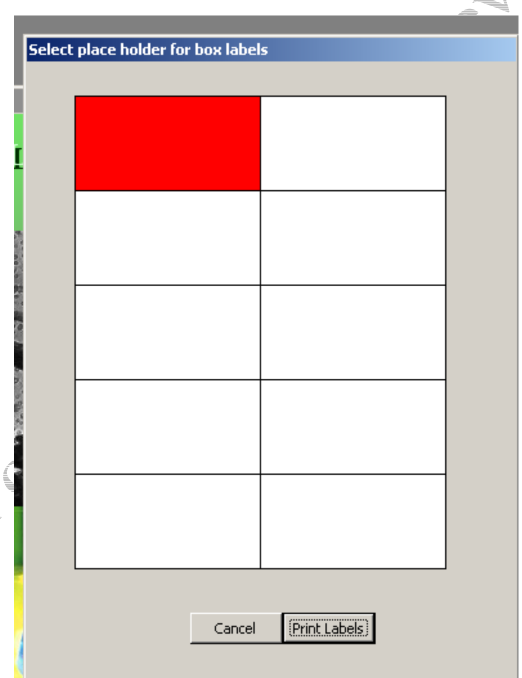
2. Use the drop down list to select the inventory batch number.

3. Click Print.

4. Place the label sheet in the printer.

5. Select the rectangle where the labels will start.

6. Click Print Labels to review the print preview screen. If corrections are needed close the preview screen and make appropriate corrections; otherwise, print the labels by selecting *File->Print*.



Section 3
QA/QC Samples

Three types of QA/QC samples are collected during the soil preparation process, they are:

- Preparation duplicate samples
- Drying blank samples
- Grinding blank samples

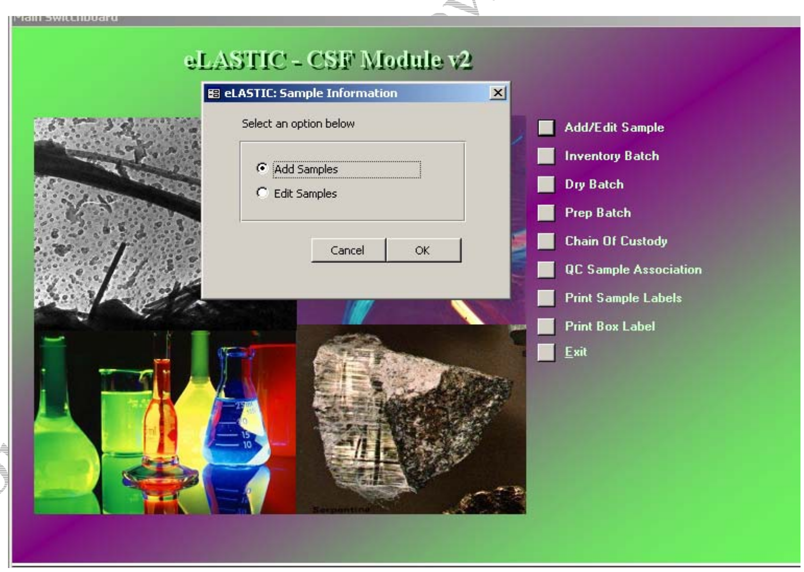
The following section details how to add QC samples to eLASTIC.

3.1 Adding QC Sample Information

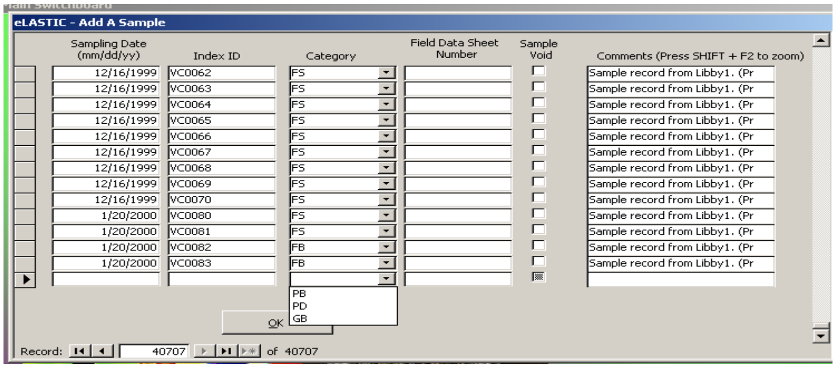
3.1.1 Adding QC Samples

The following procedure describes how to enter QC samples into eLASTIC.

1. Select Add/Edit Sample from the <Main Switchboard>. Select Add Samples from the dialog box. Click OK. This takes the user to the <Add a Sample> form.



2. In the sampling date field, enter the sample date in the form mm/dd/yy.



3. In the index ID field, enter the index identification number (index ID) of the QC sample being created.

Note: A list of index ID numbers will be provided to the CSF sample coordinator by the Libby sample coordinator on an as-needed basis.

4. For the category field, select the type of QC sample from the drop down list.
   DB = dry blank
   PD = preparation duplicate
   GB = grinding blank

Note: An index ID number can be voided at anytime using the sample void box.

5. Enter any comments in the comments field. If an index ID number is voided, an explanation should be included in the comments field.

6. Exit screen by clicking OK.

3.1.2 Edit Sample Information

Sample information can be edited by using the following procedure:

1. Select Add/Edit Sample from the <Main Switchboard>. Select Edit Samples from the dialog box. Click OK. This takes the user to the <Edit a Sample> form.

2. Place the cursor in the [Index ID] field in any row.

3. Press CTRL+F. This brings up the find dialog box. Type the Index ID to search for, and click OK.

4. Once the Index ID has been found, close the find dialog box, edit the necessary information, and click OK when complete.

Note: The <Edit a Sample> form is the same layout as the <Add a Sample> form.

3.2 Quality Control Sample Association

Each of the three types of QC samples has an association with non-QC samples.

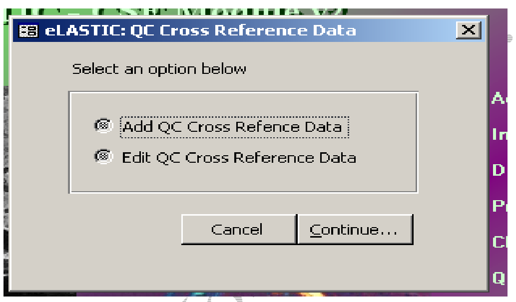
- 1 prep duplicate/20 samples prepped
- 1 dry blank/dry batch
- 1 grind blank/grinder/day of grinding

The associations between prep duplicates and dry blank associations are maintained in a cross-reference table in eLASTIC. Grinding blanks are associated by date and grinder number. Therefore, they are not added to the cross-reference table.

3.2.1 Add QC Cross-Reference Data

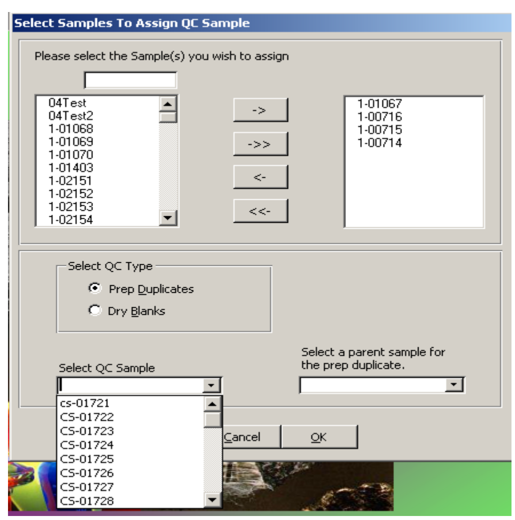
The following procedure is used to describe the process for adding QC cross-reference data.

1. Select QC Sample Association from the <Main Switchboard>. Select Add QC Cross Reference Data from the dialog box and click Continue….



2. Move the target samples associated with QC samples from the left-hand listbox to the right-hand listbox.

3. Select the QC sample type.
   a. If the QC type is a prep duplicate, then the [Select a parent sample for the prep duplicate] drop-down box will appear. The samples in the drop-down box are the same as the samples in the right-hand listbox. Select the sample that is the parent.



4. Select the index ID of the QC sample that will be associated with the field sample from the drop down list.

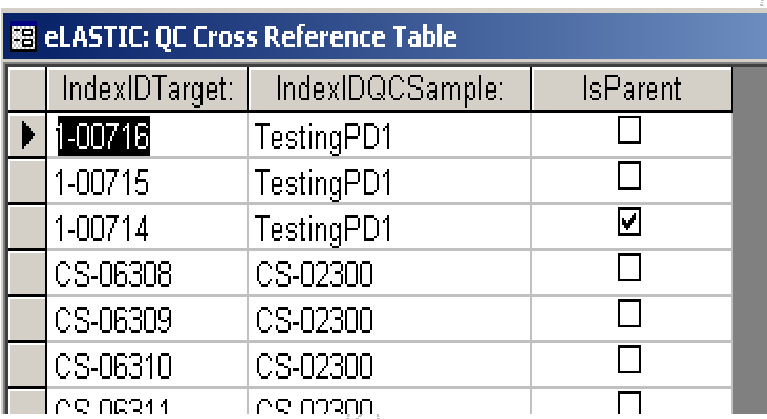
5. Click OK to close, or click Cancel to cancel the operation.

3.2.2 Edit QC Cross-Reference Data

The following procedure is used to describe the process for editing QC cross-reference data.

1. Select QC Sample Association from the <Main Switchboard>. Select Edit QC Cross Reference Data from the dialog box and click Continue….

2. The <QC Cross Reference Table> is displayed. Records can be added at the bottom, removed by selecting the entire row, or edited.


eLASTIC: QC Cross Reference Table

IndexIDTarget:	IndexIDQCSample:	IsParent
1-00716	TestingPD1	☐
1-00715	TestingPD1	☐
1-00714	TestingPD1	☑
CS-06308	CS-02300	☐
CS-06309	CS-02300	☐
CS-06310	CS-02300	☐
CS-06311	CS-02300	☐

3. Click the X in upper right-hand portion of the screen to close.

Section 4
Administration and Data Transfer Services

The administrative tasks include security and backups. The data transfer services include importing data and exporting data.

4.1 Administration

Administrative tasks should only be done by the CSF coordinator or the database administrator.

4.1.1 Security

The database requires a user name and password. There are 2 user levels. The operator level allows the user to only use the application portion. Operators cannot change the database or application structure. The administrator level allows the user access to all rights. The administrator level should be used only by the database administrator or the CSF coordinator with permission from the database administrator. The permission can be a verbal agreement.

4.1.2 Backups

The database shall be backed up daily on a zip disk. An off-site backup will be done once per week.

4.2 Data Transfer Services

A data transfer service is a process of transmitting data in or out of eLASTIC.

4.2.1 Import

There is only 1 import procedure for eLASTIC. Sampload is the process of loading a sample table from the Libby field eLASTIC module to the CSF eLASTIC module. The following procedure is used to describe the process for loading samples to the database from the field.

1. Select *File -> Import Data*.

2. On the <Import Wizard> select SAMPLOAD from the drop-down box. Select the user name.

3. Navigate to the database that contains the SAMPLOAD table in the dialog box.

4. On the <SAMPLOAD> screen click <u>Compare Samples</u>. Any records that are returned indicate there is conflicting information; such as: sample type, media, date collected. These need to be reviewed, and handled accordingly. Once any differences have been reconciled close the table and check the box next to the Compare Samples button.

5. Click Check Samples To Append. This shows all of the samples that are going to be appended to the database. Review the samples and reconcile any discrepancies. Close the table, and check the box next to the Check Samples To Append button.

6. Click Append. This will append the data to the tables. Click Cancel to exit the Import Wizard.

4.2.2 Export

There are 2 major export types. The QAM export is used to provide information to the Quality Assurance Manager. The Libby2 exports are used to provide Libby2 information in an electronic format.

4.2.2.1 QAM Export

The following procedure is used to describe the process for exporting QAM.

1. Select *File -> Export Data*

2. On the <Export Wizard> select QAM Report from the drop-down box. Select the user name. Click Export….

3. Enter the date range for the report and click Continue….

4. A message will appear 'Export Successful'. The export has been stored to relative directory…\eLASTIC\Transfer\QAMRPT\…

4.2.2.2 Libby2 Exports

Libby2 exports consist of 3 categories: ePrep, eCOC, and eQCX. The exports are sent via email as an attachment to the Export Distribution List.

Name	Email
Libby Project, Volpe Center	libby@volpe.dot.gov
Mary Goldade, EPA	goldade.mary@epamail.epa.gov
Anni Autio, CDM	AutioAH@cdm.com
Michael Waddell, CDM	WaddellML@cdm.com
David Knight, CDM	Knightdl@cdm.com

4.2.2.2.1 ePrep

The ePrep is an export of dry batch data and prep batch data for specific samples.

The ePrep file is transferred after the prep data has been completed for a particular prep batch. A prep batch is posted once the batch has been completely prepped, and a peer has reviewed the electronic data with the lab forms.

The following procedure is used to describe the process for exporting non-revision ePrep data.

1. Select *File -> Export Data*

2. On the <Export Wizard> select ePrep from the drop-down box. Select the user name. Click Export….

3. On the <ePrep Export> select the prep batches to export by checking the [Send To Volpe YN?] box. Click Export.

4. A message will appear 'Export Successful'. The export has been stored to relative directory…\eLASTIC\Transfer\ePrep\…

5. Send file as email attachment to eLASTIC Export Distribution List.

The CSF coordinator is responsible for creating and distributing Prep Data revision files. It is expected revision data will be less than 10%. The revision file is the same format as the standard file; however, this file is sent when it's created. A revision file may contain one to many update or deletion rows. The revision code describes the row as a replacement, deletion, or non-revision.

The following procedure is used to describe the process for exporting revision ePrep data.

1. Complete steps 1-4 described above for exporting non-revision files.

2. Open the MS Excel file.

3. For each record change the RevisionCode column to 'R' for replace or 'D' for deletion. If it is an insert (i.e., new record) or there is not a change to the record, then leave the revision code as 'N'.

4. Send file as email attachment to eLASTIC Export Distribution List.

4.2.2.2.2 eCOC

The eCOC is an export of COC data.

The eCOC file is transferred after the COC has been posted in eLASTIC. The CSF staff is responsible for transmitting the files to the distribution list within 24 hours of the shipment.

The eCOC revision files are created by eLASTIC; however, the CSF coordinator is responsible for distributing the files. The COC revision file contains the entire COC data for the revised record(s). A revision file may contain one to many update, addition, or deletion rows.

The following procedure is used to describe the process for exporting eCOC.

1. Select *File -> Export Data*
2. On the <Export Wizard> select eCOC from the drop-down box. Select the user name. Click Export….
3. On the <eCOC Export> select the prep batches to export by checking the [Send To Volpe YN?] box. If it is a revision file, then check the [RevisionYN] box. Click Export.
4. A message will appear 'Export Successful'. The export has been stored to relative directory…\eLASTIC\Transfer\eCOC\…
5. Send file as email attachment to eLASTIC Export Distribution List.

4.2.2.2.3 eQCX

eQCX is an export of QC cross-reference data.

The eQCX file is transferred on Friday afternoon every week. The file contains QC cross-reference data that have not been transferred as of that week. A flag in the cross-reference table describes the record as exported or not exported.

The following procedure is used to describe the process for exporting non-revision eQCX.

1. Select *File -> Export Data*
2. On the <Export Wizard> select eQCX from the drop-down box. Select the user name. Click Export….
3. A message will appear 'Export Successful'. The export has been stored to relative directory…\eLASTIC\Transfer\eQCX\…
4. Send file as email attachment to eLASTIC Export Distribution List.

The CSF coordinator is responsible for creating and distributing QC Cross Reference revision files. Like the prep data, it is expected revision data will be less than 10%. The revision file is the same format as the standard file; however, this file is sent when it's created. A revision file may contain one to many update or deletion rows. The revision code describes the row as a replacement, R, or a deletion, D.

The following procedure is used to describe the process for exporting revision eQCX.

1. Open eQCXExportTemplate.xls. Save this file as mmddyy_01aeQCX.xls in the ...eLASTIC\Transfer\eQCX\… directory; where mm = month in 2 digit format, dd = day in 2 digit format, and yy = year in 2 digit format, 01 = sequential number used to identify the count of files sent on that day. For example, if 3 files have been created on February 10, 2004, then the third file would be 021004_03aeQCX.xls.

2. Add the records to the file that are revisions. Update the RevisionCode to 'D' for deletion or 'R' for replacement.

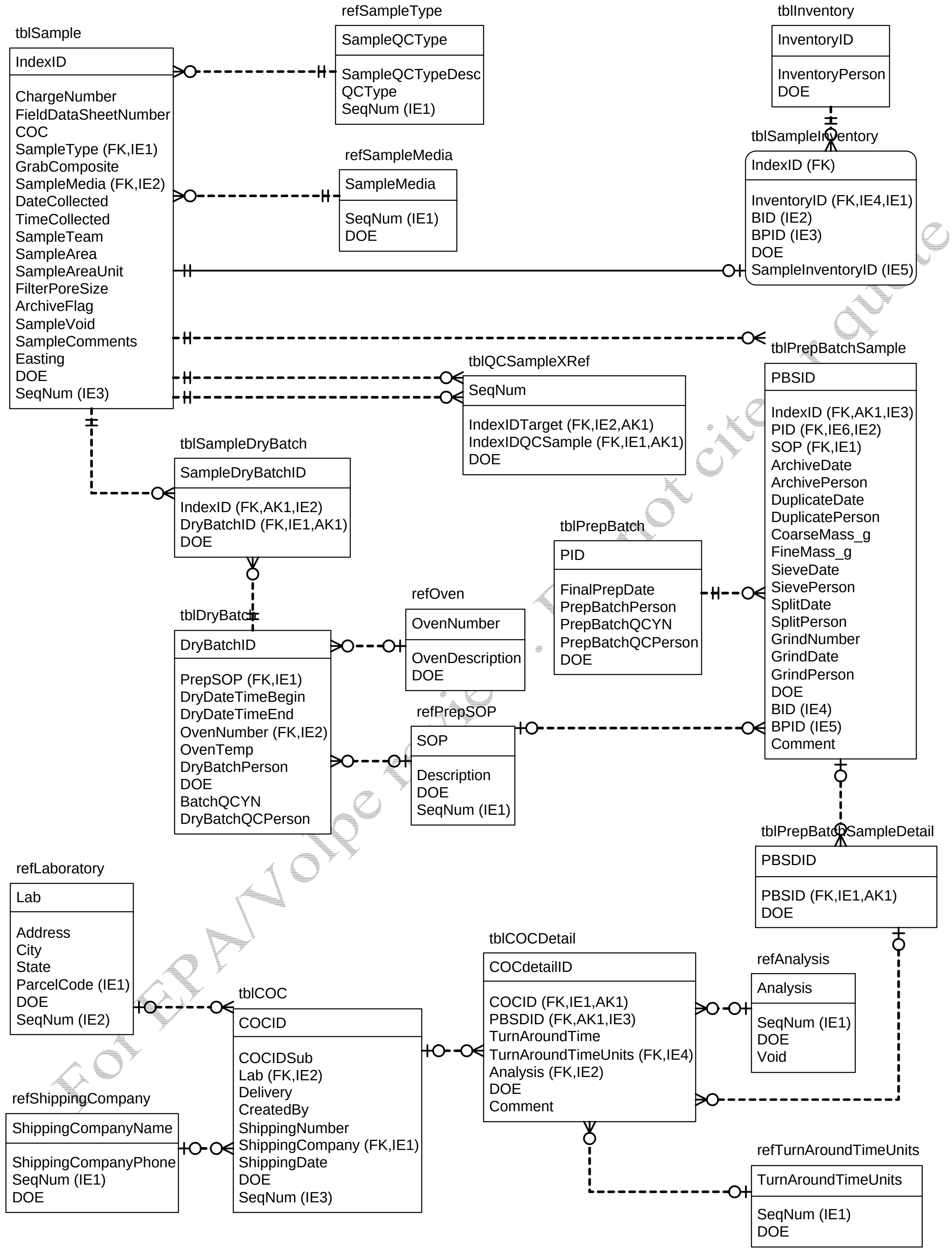
3. Send file as email attachment to eLASTIC Export Distribution List.

4.3 Metadata

Metadata include a data dictionary and an entity relationship diagram.

Data Dictionary

Figure 1 – Entity Relationship Diagram



TROY ASBESTOS PROPERTY EVALUATION (TAPE)

PROJECT-SPECIFIC GUIDANCE

TAPE FSDS and IFF Completion Guidance
Version 01

Prepared for:
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
P.O. Box 200901
Helena, MT 59620-0901

Prepared by:
TETRA TECH EM INC.
7 West 6th Avenue
Helena, MT 59601

Date:
March 13, 2006

1.0 FIELD SAMPLE DATA SHEET (FSDS) COMPLETION GUIDANCE

A field sample data sheet (FSDS) must be completed for each Troy, Montana property inspected during the Troy Asbestos Property Evaluation (TAPE) field project using the following guidance. Separate FSDS forms must be completed for Soil-Like Materials sampling and for Dust sampling.

1.1 FIELD SAMPLE DATA SHEET – SOIL-LIKE MATERIALS

1.1.1 Header Section of the FSDS

Sheet Number ____ of ____: Completed by sample field team to ensure multiple pages stay together when more than one page is needed.

Physical Address: (As it appears on the property IFF). The physical address of the property being sampled. Addresses are to be entered in the following format:
Street number – Direction – Street Name – Street Abbreviation
Where:
- Street number = the number of the street address
- Direction = the abbreviation of the street direction (N, S, E, or W), when applicable
- Street name = correct spelling of the street name
- Street abbreviation = when applicable
  - Road – Rd
  - Avenue – Ave
  - Street – St
  - Circle – Cr
  - Place – Pl
  - Boulevard – Blvd
  - Highway - Hwy

Examples: 510 N Mineral Ave
607 N Michigan Ave
521 Pipe Creek Rd

Property Identification Number: **AD-**▢▢▢▢▢▢
The AD-Number is provided by the TAPE field office coordinator and is a unique six-digit number for each Troy property.

Owner: (As it appears on the property IFF). The name of the property owner (not necessarily the current occupant).

Land Use: Description of land use for the property being sampled (circle one of the uses provided or write in description for others.

Date: Date samples are collected, in the form MM/DD/YY.

Field Logbook No.: The logbook number being used to record information specific to the samples on the FSDS.

Page No.: Page numbers in logbook with information for samples recorded on the FSDS.

Sampling Team: The names and company affiliation of sampling team.

1.1.2 Main Section of the FSDS

The following information items are provided in the Main Section of the FSDS. If more than 3 soil-like material samples are collected at a Troy property, an additional FSDS page must be completed.

Sample ID (TT): Each sample identification (ID) number is a unique five-digit number provided to the field team by the TAPE field office coordinator. Pre-printed, self-adhesive Sample ID numbers will be provided to the TAPE field teams in triplicate for labeling the FSDS column. the sample bag, and the field logbook page. Sample ID numbers for the TAPE field project are in the form TT- # # # # #.

GPS Recorded? Circle the right choice for whether the location was surveyed using global positioning survey (GPS).

Sample Point ID: A unique sample point number that will be referenced to the global positioning system (GPS) coordinates for the soil-like material sample point location in the form SP- # # # # #. A set of available numbers is assigned to each sampling team by the TAPE field office coordinator.

Category: FS = field sample or FD = field duplicate.

Matrix Type: The samples collected for the TAPE field project will mostly be surface soil samples (0 to 1 or 0 to 6 inches). If the sample is not a surface soil sample, circle one of the options provided (Sod, Fill, Mining Waste) or provide the type on the Other blank line.

Location Description: Describe the location where the soil-like material sample is collected. Circle one of the options provided (Yard, Garden, Planter, Play Area, Driveway) or provide a description on the Other blank line.

Type: Indicate the type of sample collected, grab or composite. If the sample is a composite sample, the number of sub-samples must be provided.

Sample Time: The time of sample collection, in military time.

Top Depth: Top depth of sample in inches below the ground surface.

Bottom Depth: Bottom depth of sample in inches below the ground surface.

Map Location: Provide the map number used to record the sample locations.

Field Comments: Record any information specific to that particular sample. If vermiculite is present, this must be noted in the field comments section.

Entered: Completed by Volpe personnel at time of data entry.

Validated: Completed by Volpe personnel at time of data entry check.

1.2 FIELD SAMPLE DATA SHEET – DUST SAMPLING

1.2.1 Header Section of the FSDS

Sheet Number ____ of ____: Completed by sample field team to ensure multiple pages stay together when more than one page is needed.

Physical Address: (As it appears on the property IFF). The physical address of the property being sampled. Addresses are to be entered in the following format:
Street number – Direction – Street Name – Street Abbreviation
Where:
Street number = the number of the street address
Direction = the abbreviation of the street direction (N, S, E, or W), when applicable
Street name = correct spelling of the street name
Street abbreviation = when applicable
Road – Rd
Avenue – Ave
Street – St
Circle – Cr
Place – Pl
Boulevard – Blvd
Highway - Hwy
Examples: 510 N Mineral Ave
607 N Michigan Ave
521 Pipe Creek Rd

Property Identification Number: AD-▢▢▢▢▢▢
The AD-Number is provided by the TAPE field office coordinator and is a unique six-digit number for each Troy property.

Building Identification Number: BD-▢▢▢▢▢
For dust samples, the location identification is in the form of a five-digit BD-#####. The BD number is the number assigned to the structure the dust sample is collected in. BD numbers are assigned to each sampling team by the TAPE field office coordinator.

Owner: (As it appears on the property IFF). The name of the property owner (not necessarily the current occupant).

Building Description: Description of primary function for the building being sampled (circle one of the uses provided or write in description for others.

Building Use: Further defines the use for the building being sampled (circle one of the uses provided or write in description for others.

Date: Date samples are collected, in the form MM/DD/YY.

Field Logbook No.: The logbook number being used to record information specific to the samples on the FSDS.

Page No.: Page numbers in logbook with information for samples recorded on the FSDS.

Sampling Team: The names and company affiliation of sampling team.

1.2.2 Main Section of the FSDS

The following information items are provided in the Main Section of the FSDS. If more than 3 dust samples are collected at a Troy building, an additional FSDS page must be completed.

Sample ID (TT): Each sample identification (ID) number is a unique five-digit number provided to the field team by the TAPE field office coordinator. Pre-printed, self-adhesive Sample ID numbers will be provided to the TAPE field teams in triplicate for labeling the FSDS column. the sample bag, and the field logbook page. Sample ID numbers for the TAPE field project are in the form TT- # # # # #.

Location Description (room): Provide a description of the building floor and room where the dust sample is collected. Use directional coordinates and a sketch in the field logbook to ensure that enough information is provided for each Sample TT location.

Category: FS = field sample; FD = field duplicate; or Blank.

Matrix Type: The dust samples collected for the TAPE field project will mostly be building floor dust samples (Building). A dust sample may also be collect from a vehicle or from some other matrix (Other).

Sample Area: Circle the amount of area sampled with the cassette.

Filter Diameter: Circle the appropriate filter diameter.

Pore Size: Circle the appropriate pore size.

Flow Meter Type: Circle the type of flow meter used to calibrate the pump flow rate.

Flow Meter ID No.: Record the identification number of the flow meter used to calibrate the pump flow rate.

Pump ID No.: Record the identification number of the pump used to collect the sample.

Start Time: Record the starting time of each sample aliquot collection, in military time.

Start Flow: Record the starting pump flow rate for the sample colleted in Liters per minute (L/min).

Stop Time: Record the stopping time of each sample aliquot collection, in military time.

Stop Flow: Record the stopping pump flow rate for the sample colleted in minute L/min.

Pump Fault: If the pump faulted during sample collection, circle Yes. If the pump did not fault during sample collection, circle No.

Map Location: Describe the approximate location of the dust sample on a sketch in the logbook. Record the logbook page number on the top of the Dust Sampling FSDS.

Field Comments: For each 100cm2 aliquot locations, record the specific location sampled.

Entered: Completed by Volpe personnel at time of data entry.

Validated: Completed by Volpe personnel at time of data entry check.

TROY ASBESTOS PROPERTY EVALUATION (TAPE)

PROJECT-SPECIFIC GUIDANCE

TAPE Surface Soil Sampling
Version 01

Prepared for:
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
P.O. Box 200901
Helena, MT 59620-0901

Prepared by:
TETRA TECH EM INC.
7 West 6th Avenue
Helena, MT 59601

Date:
March 13, 2006

1.0 BACKGROUND AND PURPOSE

The purpose of this TAPE project-specific guidance is to provide a standardized method for surface (0 to 1 inch) and shallow subsurface (0 to 6 inch) soil sampling to be used by the Montana Department of Environmental Quality (MDEQ) and their contractor, Tetra Tech, while completing work for the Troy asbestos property evaluations (TAPE) for the Libby Asbestos Project in Libby, Montana. This guidance describes the equipment and operations used for sampling surface and subsurface soils in residential areas, which will be submitted for the analysis of Libby amphiboles.

The MDEQ project manager must approve site-specific deviations from the procedures outlined in this document prior to initiation of the sampling activity. This guidance provides the protocols for selecting sample locations and for composite surface-soil sampling. Field personnel performing soil sampling are responsible for adhering to the applicable tasks outlined in this project-specific guidance while collecting samples at residences. The field personnel should have limited discretion with regard to collection procedures, but should exercise judgment regarding the exact location of the sample point, within the boundaries outlined by the TAPE field team leader.

2.0 TAPE OUTDOOR SOIL SAMPLING PROCEDURES

Each property will be segregated into land use areas for sampling purposes. Use areas may include, but are not be limited to:

- Yard (grassy area)
- Landscaped area
- Garden
- Fill area
- Driveway

The areas of the Troy properties that are not covered by buildings will be grouped into two general types: (1) outdoor yards and open space, and (2) specific use areas. Figure 3-2 in the TAPE Workplan provides typical outdoor soil sampling designs for these two general types of outdoor areas. Properties with grassy areas greater than approximately 5,000 square feet (ft^2) in size will be sectioned off into separate zones for increased accuracy in characterization. This segregation will be accomplished so that a five-point composite sample will characterize each section.

Sample Number and Location: A minimum of two and up to five composite soil samples will be collected from outside areas at each property. Composite soil sampling requires soil collection from multiple (sub-sample) points. Composite samples will be collected from similar land use areas (for example, yard, garden, stockpiled soil). Additional composite or individual grab samples may be collected depending on specific property conditions (for example, multiple land use areas or zones). Not all Troy properties will have definable land use areas, however, the TAPE field team will attempt to collect a minimum of two soil samples from each Troy property.

A surface soil sample will be collected from the 0 to 1 inch depth at sample points within non-disturbed areas (grassed yards). For disturbed areas (driveways, gardens, fill areas, and landscaped areas), composite soil samples will be collected from 0 to 6 inch depth. All composite soils samples will have five subsamples (aliquots) of approximately equal size. When vermiculite is observed in a land use areas (driveways and yards), a soil sample should be collected from that land use area. The location where any vermiculite is observed during soil sampling should be recorded in the field logbook and on the IFF.

Sample Collection: Field samplers should don the appropriate PPE as specified in the HASP. New plastic gloves are to be worn for each sample collected. Segregate the Troy property into land use areas, as described above. Visually inspect each land use area for visual vermiculite product. To reduce dust generation during sampling, use a sprayer with distilled water to wet each sample point prior to collection. Use the trowel to check beneath the surface soil layer, but do not advance more than 6 inches. If visible vermiculite is observed, that information should be recorded on the appropriate field forms for that land use area. Sample locations should be selected as described

Within each land use area, select five subsample locations equidistant from each other (Figure 3-2). These five subsample locations will comprise the five-point composite sample for that land use area. All composite subsamples should be from the same land use area. For example, do not mix subsamples from a garden area with subsamples from a grassy area.

Remove twigs, leaves, and other vegetative material that can be easily removed by hand at each subsample location. Using the trowel, excavate soil from an area approximately 2 inches in diameter and 1 inch deep (6 inches deep for disturbed areas) and place the excavated material directly inside a 1-gallon size reclosable plastic bag. The sides of the excavated hole should be close to vertical to avoid sampling that is biased in favor of the upper layer of soil. Repeat this step for the remaining four subsamples until the composite subsamples has been collected. The reclosable plastic bag should be approximately 1/3 to ½ full.

Homogenize the sample by first closing the plastic bag and then vigorously kneading and working the soil back and forth. Some samples may require one minute, or more, of mixing in order to thoroughly homogenize. A pre-printed, self-adhesive sample ID label will be attached to the outside of the plastic sample bag. The sample will then be double bagged and the labeling process repeated for the outer sample bag. Decontaminate the trowel between each composite soil sample, as described below.

Repeat the soil sampling steps outlined above until all soil samples from a property have been collected. Soil field duplicate samples will be collected at a rate of 1 per 20 (5 percent) of the field samples. Field duplicate samples will be collected as samples co-located in the same land use area. The duplicate will be collected from the same number of subsamples as the parent sample, but the subsample locations of the duplicate sample will be randomly located in the use area. These samples will be independently collected with separate sampling equipment. The duplicate soil samples will be used to determine the variability of sample results in a given land use area and will not be used to determine variability in sampling techniques.

Sample Location Restoration: The volume of soil removed by the TAPE sampling is small, but care will be used to return and restore each subsample point location to near pre-sampling appearance. For most sample locations, the small area can be replaced with soil from immediately surrounding the excavation and lightly tamped down. In addition, each TAPE field team will have some commercially-available potting soil or quality topsoil available to repair any small excavations that cannot be easily filled with nearby soil materials. If the sample location is a sandy area, such as a playground, refilling the soil plug will not be necessary.

Sample Decontamination: Rinse water, the roots of vegetation removed during sampling, and any small volume of excess soil may be disposed of on the ground as specified in the TAPE Workplan. A small metal shovel (if needed) and plastic trowels are the only sampling equipment that will be reused and thus requiring decontamination between sampling. All soil sampling equipment will be thoroughly decontaminated prior to any sampling use. Specific instructions on sample equipment decontamination are included in TAPE Workplan. In general, the procedure to decontaminate all equipment is outlined below:

Decontamination procedures for soil sampling equipment will follow these steps:

- Remove all gross contamination with plastic brush
- Use distilled (DI) water and a plastic brush to wash each piece of equipment
- Remove excess water present on the equipment by shaking
- Use a paper towel to dry each piece of equipment
- Wrap dried equipment in aluminum foil

Once a week all soil sampling equipment will be cleaning using Alconox and DI water.
Spent wipes, gloves, and PPE must be disposed or stored properly as specified in the TAPE Workplan.

3.0 LISTED EQUIPMENT AND RESOURCES

TAPE soil sampling may require the use of one or more of the following types of equipment and resources:

Sampling Equipment:
Trimble pro-XRS GPS unit
Digital camera
Scale bars for photographs
Phone or radio
Clipboard
Tape Measure (6 x 50-foot)
Field log book
Pocket knife
Re-closable plastic bags
Wet wipes
Waterproof permanent markers
Small metal shovel
Disposable soil trowels/scoops
Sample labels
Silica sand (asbestos-free) for soil field blanks
Secure shipment containers
Trash bags

PPE:
Disposable protective outerwear
Vinyl/nitrile gloves, various sizes

Decon:
Paper towels
Bristle brushes
Water spray bottles
5-gallon buckets
Surfactant (Alconox)
Distilled (DI) water

Field Forms:
IFFs
FSDSs
Interview forms
Field audit forms

TROY ASBESTOS PROPERTY EVALUATION
FIELD EQUIPMENT AND SUPPLIES

Rental equipment:
7 battery-operated low-flow air pumps (5 required plus 2 for backup)
Calibration for pumps (Dry-Cal?)
6 Trimble pro-XRS GPS units (5 required plus 1 for backup)
6 digital cameras
6 Phones/radios (one for field office, one for each team)
Photocopier
Vehicles

Purchase/From Supplies:
2 laptop computers

Inspection:
10 clipboards
6 x 50-foot tape measures
Palette knives, etc. (for looking under insulation)
5 non-conductive stepladders (for attic, barn inspections)
Scale bars for photographs
Field log books
5 HEPA vacuums

Sampling:
Pocket knives
Re-closable plastic bags, various sizes
Duct tape
Wet wipes
Waterproof permanent markers
Soil trowels and scoops (disposable)
Small shovels
Sample labels
Silica sand (asbestos-free) for soil field blanks
Secure shipment containers
Trash bags
Plastic floor covering

PPE:
Respirator for each asbestos inspector
Replacement particulate respirator cartridges
Vinyl/nitrile gloves, various sizes
Disposable protective outerwear

Decon:
Paper towels
Bristle brushes
Water spray bottles
5-gallon buckets
Surfactant (Alconox)
Deionized water

Lab-supplied:
Microvacuum dust sampling cassettes
¼-inch diameter plastic tubing, cut at 45^o angle
$100cm^2$ templates
Sample shipment security seals

Field Forms:
IFFs
FSDSs (Dust and Soil-Like Materials)
Interview forms
Field audit forms

Date

Name
Address
City ST Zip

Subject: Troy Asbestos Property Evaluation

Dear :

The Montana Department of Environmental Quality (DEQ), in consultation with the United States Environmental Protection Agency (EPA), and Tetra Tech EM Inc (TtEMI) (an environmental consulting firm retained by DEQ) plan to conduct an Asbestos Property Evaluation for properties in the Troy area this summer. This investigation is a part of the larger asbestos clean up activities currently occurring in Libby.

Pursuant to Section 104(b) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §9604(b), DEQ requests access to your property located at **********, Troy. The investigation will include inspection and photodocumentation as needed of all areas (living spaces, walls, basements, attics, etc.) inside buildings on the property and outside of the buildings. DEQ will also collect soil, building material, and dust samples from the buildings and around the property. We will be looking for any vermiculite-contaminated insulation or other building materials and vermiculite contaminated soils. The information collected during this investigation will determine the need for any future cleanup of vermiculite contamination on your individual property.

DEQ would like to conduct these activities in cooperation with you and is providing you a request to obtain access. This is also an opportunity for you to raise any specific questions or concerns. Please feel free to use any of the following resources to obtain additional information or ask any questions you may have.

- Catherine LeCours, DEQ Project Officer, phone toll free 1-800-246-8198 or e-mail at clecours@mt.gov
- EPA Information Center in Libby - 501 Mineral Ave, phone toll free at 1-888-420-6810, or visit the Center Monday through Friday from 8:30 a.m. to 5:00 p.m.
- City Hall in Troy - 301 E. Kootenai, available Monday through Friday from 8:00 a.m. to 5:00 p.m.
- On the Internet at http://www.epa.gov/region8/superfund/libby.html

Two copies of a "Consent for Entry and Access to Property" form are enclosed. Please review, sign one and return it to me in the enclosed envelope no later than ****date****. DEQ will then contact you to schedule the inspection at your convenience. Please retain the other copy for your records.

The Troy Asbestos Property Evaluation is part of the Libby Asbestos Superfund Site process and is being conducted under a cooperative agreement between DEQ and EPA. Please feel free to contact me at the numbers above with any questions or concerns.

Sincerely,

Catherine LeCours
Superfund Project Manager
Remediation Division

Enclosure: Postage paid envelope
2 access agreements

STATE OF MONTANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
1100 NORTH LAST CHANCE GULCH
PO BOX 200901
HELENA MT 59620

CONSENT FOR ENTRY AND ACCESS TO PROPERTY

Name: ______________________________

Address: ______________________________ Phone (home): ______________
______________________________ (work): ______________
______________________________ (cell): ______________

Address of Property for which consent for entry and access is being granted:

____
____
____

Relationship to property: ___________________
(i.e., owner, owner's representative, tenant, etc.)

I, the undersigned, am the owner, their representative, or otherwise control the real property at the location described above. The State of Montana's Department of Environmental Quality (DEQ) and the United States Environmental Protection Agency (EPA) has requested entry and access to my property pursuant to its response and enforcement responsibilities under the Comprehensive Environmental Response, Compensation and Liability Act as amended (Superfund), 42 U.S.C. 9601 et seq.

I consent to officers, employees, and authorized representatives of the DEQ and EPA, including their authorized contractors, entering and having continued access to my property for the following purposes:

1. Visually inspecting and photographing the property, including the interior and exterior of any home or any other structures on the property;

2. The taking of such soil, building material, or dust samples as may be determined to be necessary;

3. The taking of actions to mark or temporarily cover exposed vermiculite.

______________________________ ______________
Signature Date

Montana Department of Environmental Quality
Remediation Division/Federal Superfund Section
1100 North Last Chance Gulch
PO Box 200901
Helena MT 59620-0901
406.841.5040 or 1.800.246.8198

Receipt for Samples

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 9604(e) authorizes the Montana Department of Environmental Quality (DEQ), its officers, employees and representatives access to inspect and obtain samples from surface and subsurface soils or water (including groundwater) from the property identified below. This investigation authority extends to any facility, establishment or other place or property where any hazardous substance, pollutant or contaminant may be or has been generated, stored, treated, placed, disposed of, transported from or has otherwise come to be located or from which there has been or may be a release or threatened release or where entry is needed to determine the need for response, the appropriate response or to effectuate a response.

Property Owner/Operator Information:

Name:____

Physical Address of property under investigation: ____

Mailing Address:____

Phone (optional): ____

The following samples have been collected from this property:

Date	Media	Sample ID Number	Analysis to be performed

The above referenced samples have been collected in accordance with a sampling and analysis plan:
- ❑ Without variation; or
- ❑ With the following variation(s) from the plan:

  ____
  ____

The property owner/operator was offered a portion of the samples taken (split samples) at the person's cost. The property owner/operator elected to:
- ❑ Accept a split sample; or
- ❑ Decline a split sample.

DEQ will mail the sampling results to the person identified above when they become available.

Copy of this receipt provided to property owner/operator.

DEQ representative:

___________________________________ CATHERINE LeCOURS______________________
Signature Printed Name

Date:_________________

Property owner/operator copy = white DEQ copy = yellow

Sheet Number ____of____

TROY ASBESTOS PROPERTY EVALUATION
FIELD SAMPLE DATA SHEET
Dust Sampling

Physical Address: ____

Property Identification Number: AD - __________

Building Identification Number: BD - ____________

Owner: ____

Building Description: Primary Garage Barn Shed Other ___________

Building Use: Residential School Commercial Other________________

Date: _______________

Field Logbook No.: __________ Pages No.: ___________

Sampling Team: ____

Data Item	Sample 1			Sample 2			Sample 3		
Sample ID (TT)									
Location Description (room)									
Category	FS__________ FD__________ Blank__________			FS__________ FD__________ Blank__________			FS__________ FD__________ Blank__________		
Matrix	Building Vehicle Other __________			Building Vehicle Other __________			Building Vehicle Other __________		
Sample Area (cm^2)	300 Other ______			300 Other ______			300 Other ______		
Filter Diameter	.45um .37 um			.45um .37 um			.45um .37 um		
Pore Size	TEM PCM			TEM PCM			TEM PCM		
Flow Meter Type									
Flow Meter ID No.									
Pump ID No.									
Start Time									
Start Flow (l/min)									
Stop Time									
Stop Flow (l/min)									
Pump Fault?	No Yes			No Yes			No Yes		
Map Location									
Field Comments									
	Entered_______ Validated _______			Entered_______ Validated _______			Entered_______ Validated _______		

Interview for Residents/Employees of Troy, Montana

Date____________ Time:___________ Interviewers: ___________________________

____

Physical Address of Property: ____

Property Identification Number: AD-________________

	Name	Mail Address	Physical Address	Contact Phone
Property Owner				
Property Occupant				

If you need more room for responses, please continue writing on the back of each page, with the question number clearly identified.

1. Primary contact name and phone number (for follow-up questions/concerns):

   ____

2. Names and approximate age of all residents of the house or workers in the commercial establishment – enter information into table below (indicate with an * all members that participated in the interview). Comments – indicate if seasonal resident/employee, temporary resident/employee, any other pertinent info offered.

Name	Age	Comments

3. How long has your family been living/business operational in Troy?
   ___________ years
4. How long has your family been living/in business at your current address?
   ___________ years
5. Do you have outdoor pets? Yes No If yes, do they come inside at all?

   ____
6. If you have asbestos-related health concerns, where do you go for information?

   ____
7. Do you have any specific asbestos-related health concerns you would like to share? If yes please describe. ** There is no requirement to provide personal/medical information and no guarantee it will remain confidential**

   ____

   ____
8. Did anyone in your family/employment work at the vermiculite mine or the vermiculite processing operations? If so, please provide job title/description of duties, and approximate dates of employment. If no, skip to Question #11.

   ____

   ____
9. Typically after a day of work, did family members working in the vermiculite mining or processing operations (circle one):

   a) change clothes at work, or b) wear their work clothes home?
10. How did family members most frequently get to and from the vermiculite work site? (circle one):

    a) personal vehicle, b) ride from coworker, c) bus, d) other.
11. To the best of your knowledge, was vermiculite from the mine used in or around your home? Yes No

    If no, skip to Question #16.

    If so, was the vermiculite used in/around your home purchased from a store? Yes No
    If no, where did you get it from?____
12. Was the vermiculite used for insulation? Yes No

    If yes, please describe locations: ____

    ____
13. If yes, is dust from the vermiculite insulation often visible in any of the living areas of the house? Yes No
14. Was the vermiculite used for (circle all applicable):

    a) gardens, b) planting, c) greenhouse?

15. Were there other ways the vermiculite was used? Yes No If yes please describe:

____

____

16. What year was your house built? ______________

17. Are you aware of any asbestos-containing products other than Libby vermiculite in your home - such as floor tiles, pipe insulation, siding? Yes No

    If yes, please describe: ________________________________

    ____

18. Besides work, did any of the family participate in any activities that bring them frequently into contact with the mine/processing facilities/vermiculite? Yes No

    If so please describe: ________________________________

    ____

    Can you think of any way vermiculite might have gotten into your home now or in the past (i.e. on clothing?) Yes No
    If so please describe: ________________________________

    Do you know of any areas around Troy where vermiculite from the mine has been placed? Yes No If so, please list: ________________________

    ____

19. Is there anything else you would like to say about the mine?

____

____

20. Is there anything you'd like more information about?

____

____

21. What do you think is the best way to communicate with people in Troy?

    a) newspaper, b) newsletter, c) radio, d) civic organizations,
    e) meetings, f) other (please describe: ________________________)

    Any other input regarding public outreach, meetings? __________________

    ____

22. Can you think of any other people we should talk with? Yes No

    If yes, who: ________________________________

    ____

TROY ASBESTOS PROPERTY EVALUATION
FIELD SAMPLE DATA SHEET
Soil-Like Materials

Physical Address: ____

Property Identification Number: AD - _________________

Owner: ____

Land Use: Residential School Commercial Mining Logging
Roadway Other________________

Date: _______________

Field Logbook No.: __________ Pages No.: ___________

Sampling Team: ____

Data Item	Sample 1	Sample 2	Sample 3
Sample ID (TT)			
GPS Recorded?	No Yes	No Yes	No Yes
Sample Point ID (SP)			
Category	FS__________ FD__________	FS__________ FD__________	FS__________ FD__________
Matrix	Surface Soil Sod Fill Mining Waste Other __________	Surface Soil Sod Fill Mining Waste Other __________	Surface Soil Sod Fill Mining Waste Other __________
Location Description	Yard Garden Planter Play Area Driveway Other ___________	Yard Garden Planter Play Area Driveway Other ___________	Yard Garden Planter Play Area Driveway Other ___________
Type	Grab Composite - # subsamples: ______	Grab Composite - # subsamples: ______	Grab Composite - # subsamples: ______
Sample Time			
Top Depth (in.)			
Bottom Depth (in.)			
Map Location			
Field Comments			
	Entered_______ Validated _______	Entered_______ Validated _______	Entered_______ Validated _______

Troy, MT Inspection Field Form

Physical Address: ____

Property Identification Number: AD - ____________

Building Number: BD - ____________ (Insert at top right of each page of IFF)

Commercial or residential property (circle one)? Commercial Residential Both

Site visit date and time: ____

Field log book number and page: ____

Inspection team members: ____

Owner/primary contact providing access: _______________________________________

Phone number for primary contact: ____

Inspection Form	If Used, how many separate sheets	Not Used
Primary Structure Attic		
Primary Structure Living Space		
Primary Structure Understructure		
Primary Structure Utilities		
Exterior Inspection		
Secondary Structures		

Inspection Item	Value	Comments
PRIMARY STRUCTURE ATTIC (use a separate form for each separate attic space)		
Type of attic	Finished Unfinished	
Multiple attics?	Yes No Attics within attics	
Location of attic entries	Inside house Outside house None	*Sketch location on property map*
Number of attic entries	1 2 3 Other:____	
Type of attic entry	Stairs Door Removable panel Other: _______________	*If unusual shape/size, please note*
Attic used for storage?	Yes No	*Brief description:*
Kneewalls present?	Yes No	
Areas behind kneewalls accessed?	Yes No	*If yes, describe access:*
Areas behind kneewalls used for storage?	Yes No	*Brief description:*
Is finished attic furnished?	Yes No	*Brief description:*
Factors impeding potential cleanup? (i.e., presence of support beams/exposed electrical wires/HVAC)	Yes No	*Brief description:*
General condition of ceiling and floors	Good Poor	
Can all areas in attic be accessed?	Yes No	
Are any areas in attic segregated into individual rooms?	Yes No	*Brief description:*

PRIMARY STRUCTURE ATTIC-Continued (use a separate form for each separate attic space)		
Attic shows evidence of physical damage?	Yes No	*Brief description:*
Attic shows evidence of water damage?	Yes No	*Brief description:*
Apparent structural condition of roof	Good Poor	
Any other structural concerns?		
VCI observed in attic?	Yes No	*Sketch on property map and describe:*
Depth of VCI in attic	___________ inches	
Square footage of area with VCI?	___________ square feet	
Items in attic in contact with VCI?	Yes No	*Brief description:*
Other insulation in attic?	Yes No	*Type: Fiberglass Cellulose Other* _____________
VCI in interior walls?	Yes No Unknown	
VCI in exterior walls?	Yes No Unknown	
Other insulation in walls?	Yes No Unknown	*Type: Fiberglass Cellulose Other* _____________
Is other insulation in contact with VCI?	Yes No	*Brief description:*
Is VCI visibly leaking into living space?	Yes No	*Brief description:*

PRIMARY STRUCTURE LIVING SPACE (use a separate form for each building level if additional detail is necessary)			
Number and type of room in building; furnished/unfurnished (not including attic)	Basement: Ground floor: First floor: Second floor: Other: ______________________________		
Ceiling cracks as viewed from living space?	Yes	No	*Sketch on property map*
Utility conduits in attic leading to living space?	Yes	No	*Sketch on property map*
If yes, was VCI observed around conduits?	Yes	No	
Is VCI visible in HVAC registers?	Yes	No	
Vermiculite observed in houseplant soil?	Yes	No	*Describe:*
Evidence of vermiculite used in building materials?	Yes	No	*Describe:*

PRIMARY STRUCTURE UNDERSTRUCTURE (use a separate form if differing understructures for a single primary structure)		
Type of understructure	Basement Crawlspace Other: ________________ None	
Access to understructure	Yes No	*Locations:*
VCI observed in understructure?	Yes No	

PRIMARY STRUCTURE UTILITIES (check all that apply)		
Heating system for primary structure:	Fuel Oil Electric Propane Wood Stove Other: ________________	
Heating type:	Forced air Radiant heat	
Electrical shutoff system observed?	Breaker box Fuse box Other: ______________	*Sketch on property map*
Water source	City water Private well Other: ________________	

EXTERIOR INSPECTION		
Evidence of vermiculite used in building materials?	Yes No	
Visible vermiculite on property?	Yes No	*Sketch on property map*
Vegetation/cover *contaminated area only*	Grass None Other: ____________	
Trees within contaminated area?	Yes No	*Locations, type and size:*
Shrubs within contaminated area?	Yes No	*Locations, type and size:*
Fence present within contaminated area?	Yes No	*Describe:*
Items located on contaminated area?	Yes No	*Describe:*
Number of flowerbeds that have visible vermiculite in soil?		*Sketch on property map*
Contaminated flowerbeds contain flowers/plants?	Yes No	*Describe:*
Number of gardens that have visible vermiculite in soil?		*Sketch on property map*
Garden contains crops?	Yes No	*Describe:*
Type of driveway:	Concrete Gravel Asphalt Soil Other _______________ None	

EXTERIOR INSPECTION-Continued		
Visual evidence of contamination in driveway?	Yes No	*Describe:*
If visual evidence of contamination, approximate dimensions:	Length ___________ feet Width ___________ feet	
Vermiculite observed in flower pots/ hanging baskets?	Yes No	*Sketch on property map*
Evidence of fill material on property?	Yes No	*Sketch on property map*
Any underground utilities visible or known to be present?	Yes No	*Describe and sketch on property map:*
Any aboveground utilities observed?	Yes No	*Describe and sketch on property map:*

SECONDARY STRUCTURES (use a separate page for each secondary structure)		
Secondary structures present?	Shed Deck Carport Garage Barn Greenhouse Other: ______________	
VCI observed inside secondary structures?	Yes No	*Describe:*
Other insulation in secondary structures?	Yes No Unknown	*Type: Fiberglass* *Cellulose* *Other* _____________
Is other insulation in contact with VCI?	Yes No	
Secondary structure finished or used for storage?	Finished Unfinished Storage Vacant Other ______________	*Brief description:*
Items in secondary structure in contact with VCI?	Yes No	*Brief description:*
Visual evidence of contamination beneath secondary structures?	Yes No	*Describe:*

PHOTOGRAPH LOG:

1.____

2. ____

3. ____

4. ____

5. ____

6. ____

7. ____

8. ____

9. ____

10. ____

ADDITIONAL INFORMATION: